

# NAVAL POSTGRADUATE SCHOOL

Monterey, California



THESIS

19960806 007

THE HAE UAV AND DYNAMIC RETASKING BY  
TACTICAL COMMANDERS

by

Howard Todd Waller

June 1996

Principal Advisor:

Michael G. Sovereign

Approved for public release; distribution is unlimited

**REPORT DOCUMENTATION PAGE**Form Approved  
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

<b>1. AGENCY USE ONLY (Leave blank)</b>		<b>2. REPORT DATE</b> June 1996	<b>3. REPORT TYPE AND DATES COVERED</b> Master's Thesis	
<b>4. TITLE AND SUBTITLE</b>  THE HAE UAV AND DYNAMIC RETASKING BY TACTICAL COMMANDERS			<b>5. FUNDING NUMBERS</b>	
<b>6. AUTHOR(S)</b>  Waller, Howard, T.				
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b>  Naval Postgraduate School Monterey, CA 93943-5000			<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b>	
<b>9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b>			<b>10. SPONSORING / MONITORING AGENCY REPORT NUMBER</b>	
<b>11. SUPPLEMENTARY NOTES</b>  The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.				
<b>12a. DISTRIBUTION / AVAILABILITY STATEMENT</b>  Approved for public release; distribution is unlimited.			<b>12b. DISTRIBUTION CODE</b>	
<b>13. ABSTRACT (Maximum 200 words)</b>  Advancing technology and the changing nature and tempo of modern warfare has created many challenges. Desert Storm reiterated the need for Near-Real Time (NRT) imagery of the battlefield. History shows that Unmanned Aerial Vehicles (UAV) have the capability to meet some of these challenges. The Defense Airborne Reconnaissance Office (DARO) is directing a program to develop a family of UAVs that will meet the future NRT imagery needs of operational commanders. The High Altitude Endurance (HAE) UAV is part of this family of UAVs that will serve to provide sustained, broad area coverage for those commanders with time critical needs.  The thrust of this thesis is to define a process by which the time-critical Reconnaissance Surveillance and Target Acquisition (RSTA) imagery needs of the tactical commander on the battlefield can be met through effective dynamic retasking of the HAE UAV. This thesis examines HAE UAV capabilities, the intelligence cycle, and collection management procedures. Prohibitors of timely intelligence are highlighted. A process is described through which the HAE UAV may be dynamically retasked to meet the ground force commander's real-time collection requirements. The appropriateness of the HAE UAV to be used to satisfy the ground force commander's dynamic requirements is discussed.				
<b>14. SUBJECT TERMS</b>  unmanned aerial vehicles, intelligence cycle, collection mamangement, dynamic retasking			<b>15. NUMBER OF PAGES</b>  111	
			<b>16. PRICE CODE</b>	
<b>17. SECURITY CLASSIFICATION OF REPORT</b> Unclassified	<b>18. SECURITY CLASSIFICATION OF THIS PAGE</b> Unclassified	<b>19. SECURITY CLASSIFICATION OF ABSTRACT</b> Unclassified	<b>20. LIMITATION OF ABSTRACT</b>  UL	



Approved for public release; distribution is unlimited

**THE HAE UAV AND DYNAMIC RETASKING BY TACTICAL  
COMMANDERS**

Howard T. Waller  
First Lieutenant, United States Air Force  
B.S., United States Air Force Academy, 1992

Submitted in partial fulfillment of the  
requirements for the degree of

**MASTER OF SCIENCE IN SYSTEMS TECHNOLOGY**

from the

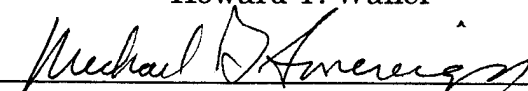
**NAVAL POSTGRADUATE SCHOOL  
June 1996**

Author: \_\_\_\_\_

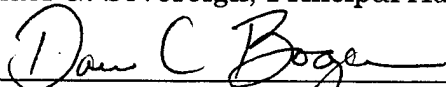


Howard T. Waller

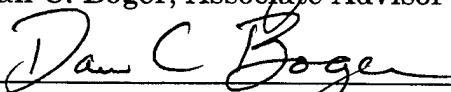
Approved by: \_\_\_\_\_



Michael G. Sovereign, Principal Advisor



Dan C. Boger, Associate Advisor



Dan C. Boger, Chairman

Command, Control, Communications, Computers and Intelligence Academic  
Group



## ABSTRACT

Advancing technology and the changing nature and tempo of modern warfare has created many challenges. Desert Storm reiterated the need for Near-Real Time (NRT) imagery of the battlefield. History shows that Unmanned Aerial Vehicles (UAV) have the capability to meet some of these challenges. The Defense Airborne Reconnaissance Office (DARO) is directing a program to develop a family of UAVs that will meet the future NRT imagery needs of operational commanders. The High Altitude Endurance (HAE) UAV is part of this family of UAVs that will serve to provide sustained, broad area coverage for those commanders with time critical needs.

The thrust of this thesis is to define a process by which the time-critical Reconnaissance Surveillance and Target Acquisition (RSTA) imagery needs of the tactical commander on the battlefield can be met through effective dynamic retasking of the HAE UAV. This thesis examines HAE UAV capabilities, the intelligence cycle, and collection management procedures. Prohibitors of timely intelligence are highlighted. A process is described through which the HAE UAV may be dynamically retasked to meet the ground force commander's real-time collection requirements. The appropriateness of the HAE UAV to be used to satisfy the ground force commander's dynamic requirements is discussed.



## TABLE OF CONTENTS

I.	INTRODUCTION .....	1
A.	W.W.I ERA .....	1
B.	V-1 BUZZ BOMB.....	2
C.	FIREBEE TO AQM-34.....	2
D.	"BUFFALO HUNTER" IN NORTH VIETNAM .....	3
E.	UAVS FOR THE MODERN BATTLEFIELD .....	3
	1. Israeli use of UAVs .....	4
	2. Pioneer in Desert Storm .....	5
F.	UAVS FOR TOMORROW.....	6
II.	THE HAE UAV SYSTEM.....	9
A.	BACKGROUND .....	9
B.	SYSTEM CAPABILITIES .....	11
C.	SYSTEM DESCRIPTION.....	14
	1. Air Vehicle Segment .....	15
	2. Launch and Recovery Element.....	15
	3. Mission Control Element.....	16
	4. Ground Communication Element .....	17
	5. Support Element .....	17
D.	MISSIONS AND TASKS.....	17
E.	IMAGERY TRANSMISSION .....	20
	1. Line-of-sight High Data Rate Imagery .....	20
	2. Long Haul High Data Rate Imagery.....	21
F.	EXPLOITATION .....	22
G.	COMMAND AND CONTROL .....	22
H.	TASKING.....	23
III.	COLLECTION MANAGEMENT FOR JOINT OPERATIONS .....	27
A.	INTELLIGENCE CYCLE .....	27



1. Planning and Direction .....	27
2. Collection .....	29
3. Processing .....	31
4. Production.....	31
5. Dissemination.....	33
B. THEATER COLLECTION MANAGEMENT.....	33
1. Develop Requirements .....	35
2. Develop Collection Plan .....	37
3. Task or Request Collection .....	40
4. The J-2 and the Joint Intelligence Center .....	41
5. The J-3 and The Joint Reconnaissance Center.....	43
6. Joint Force Air Component Commander.....	43
7. Dynamic Retasking .....	45
C. JOINT COLLECTION MANAGEMENT TOOL.....	46
IV. PROHIBITORS OF TIMELY INTELLIGENCE .....	49
A. NATIONAL COLLECTION EMPHASIS .....	49
B. J-2 STAFF COLLECTION EXPERIENCE .....	53
C. LIMITED COLLECTION ASSETS .....	53
D. SUPPORTING TOOLS FOR COLLECTION MANAGEMENT .....	54
E. AIR TASKING ORDER GENERATION .....	54
F. TASKING PROCEDURES.....	55
V. SCENARIO ASSUMPTIONS .....	57
A. BACKGROUND .....	57
B. THEATER ASSUMPTIONS .....	57
1. Collection Management Responsibilities .....	58
2. Basing Considerations .....	58
3. Communications and Supporting Tools .....	59
C. TASKING SCENARIO .....	59
VI. PROCESS FOR DYNAMIC RETASKING.....	61

A. INTRODUCTION .....	61
B. JOINT FORCE COMMANDER'S ROLE.....	61
C. J-2 STAFF CONTINGENCY .....	62
D. TASKING PROCESS AND FLOW OF REQUIREMENTS.....	64
1. Initiating the Request For Information .....	64
2. Dynamic Requirements Collection Management Authority .....	67
3. HAE UAV Operational Unit .....	70
E. RECOMMENDATIONS .....	74
1. Possible Problems.....	74
2. Requester Competency .....	76
F. SUMMARY .....	77
VII. FURTHER CONSIDERATIONS .....	79
A. BACKGROUND.....	79
B. TIMELINESS .....	79
C. DEEP BATTLE CONSIDERATIONS .....	80
D. RANGE CONSIDERATIONS .....	81
E. CONCLUSIONS .....	82
LIST OF REFERENCES .....	85
INITIAL DISTRIBUTION LIST.....	89



## **LIST OF ACRONYMS**

ACC	Air Combat Command
ACP	Air Control Plan
ACTD	Advanced Concepts Technology Demonstration
AFM	Army Field Manual
AOC	Air Operations Center
AOR	Area of Responsibility
ARPA	Advanced Research Projects Agency
ASAS	All Source Analysis System
ATO	Air Tasking Order
BDA	Battle Damage Assessment
C2	Command and Control
C4I	Command, Control, Communications, Computers, and Intelligence
CARS	Contingency Airborne Reconnaissance System
CDL	Common Data Link
CIG/SS	Common Imagery Ground/ Surface Station
CINC	Commander-in-Chief
CIO	Central Imagery Office
CIS	Combat Information System
CMA	Collection Management Authority
CMST	Collection Management Support Tools
CONOPS	Concept of Operations
COM	Collection Operations Management
COTS	Commercial Off-the-Shelf
CRM	Collection Requirements Management

CRMA	Collection Requirements Management Application
CRMS	Collection Requirements Management System
DARO	Defense Airborne Reconnaissance System
DARS	Daily Aerial Reconnaissance System
DIAM	Defense Intelligence Agency Manual
DISN	Defense Integrated Secure Network
DoD	Department of Defense
DRCMA	Dynamic Requirements Collection Management Authority
EAC	Echelons Above Corp
ECM	Electronic Counter Measures
EEI	Essential Elements of Information
EO	Electro-Optical
ETRAC	Enhanced Tactical Radar Correlator
GCE	Ground Communications Element
GMTI	Ground Motion Target Indication
GOTS	Government Off-the-Shelf
HAE	High Altitude Endurance
HUMINT	Human Intelligence
IARS	Integrated Airborne Reconnaissance Strategy
IAS	Intelligence Analysis System
IMINT	Imagery Intelligence
IPB	Intelligence Preparation of the Battlefield
IR	Infrared

JAOC	Joint Air Operations Center
JCMT	Joint Collection Management Tool
JCMC	Joint Collection Management Cells
JCS	Joint Chiefs of Staff
JDISS	Joint Deployable Intelligence Support System
JFACC	Joint Force Air Component Commander
JFC	Joint Force Commander
JIC	Joint Intelligence Center
JMCIS	Joint Maritime Command Information Center
JPO	Joint Program Office
JRC	Joint Reconnaissance Center
JSIPS(N)	Joint Services Imagery Processing System (Navy)
JSTARS	Joint Surveillance Target Acquisition System
JTF	Joint Task Force
LOS	Line of Sight
LRE	Launch and Recovery Element
MASINT	Measurement and Signal Intelligence
MATM	Multiple Assets Tasking Message
Mbits/s	Megatbits per second
MCE	Mission Control Element
MIES	Modernized Imagery Exploitation System
MILSAT	Military Satellite
MIST	Modular Interoperable Surface Terminal
NIIRS	National Imagery Interpretability Rating Scale
NPIC	National Photographic Interpretation Center
NRT	Near-Real-Time

OPCON	Operational Control
OTH	Over-the-Horizon
PIR	Priority Information Request
RFI	Request For Information
RSTA	Reconnaissance, Surveillance, and Target Acquisition
SAM	Surface-to-Air-Missile
SAR	Syrthetic Aperture Radar
SATCOM	Satellite Communications
SE	Support Element
SIGINT	Signal Intelligence
SIR	Specific Information Requirement
SOR	Specific Orders Request
TADIX-B	Tactical Data Information Exchange System - Broadcast
TIBS	Tactical Information Broadcast Service
TOC	Tactical Operations Center
TRAP	Tactical Receive Equipment and Related Applications
TRIXS	Tactical Reconnaissance Intelligence Service
TV	Television
UAV	Unmanned Aerial Vehicle
UHF	Ultra-High Frequency
US	United States
USACOM	United States Atlantic Command
USCENTCOM	United States Central Command

USIS	United States Imagery System
USSR	Union of Soviet Socialist Republics





## EXECUTIVE SUMMARY

As advancing technology continues to make possible the use of more and more sophisticated weapons for the modern battlefield, changes in the art of war are inevitable. One such change is the tempo at which battlefield engagements are conducted. The desire to "get inside" of the enemy's decision loop has precipitated the need to act faster and smarter during combat. With this need also comes the need for real-time intelligence support to battlefield commanders. Desert Storm served as a reminder that the current intelligence architecture is not equipped to provide tactical commanders with real-time intelligence through the dynamic retasking of collection assets. However, the dawning of more sophisticated unmanned aerial vehicle (UAV) technology and the history of successful UAV use during previous conflicts offers hope for meeting the real-time intelligence needs of tactical commanders in the future.

This thesis reveals the successful use of UAVs throughout their short history and discusses the capabilities of one developmental UAV in particular, the High Altitude Endurance (HAE) UAV. The current intelligence system is also discussed and the method by which army tactical commanders request intelligence within a theater of operations is examined. These processes are examined in detail in order to understand the current process through which tactical commanders request intelligence on the battlefield. This examination offers insight into what problems exist which prevent battlefield commanders from getting the intelligence they need during time-critical situations. Time is also devoted to the discussion of what may be considered *prohibitors* to timely intelligence. This thesis discusses the historical emphasis on national collection at the expense of tactical collection, as well as specific problems encountered during Operation Desert Storm which prevented timely intelligence.

Once these ideas have been fully developed, a *probable* scenario is described in which a tactical commander may require real-time intelligence support. It is

important that the reader understand that the unpredictable nature of warfare makes it very difficult, if not impossible, to describe the *typical* scenario; therefore, a *probable* scenario will have to suffice. This scenario also serves to limit the scope of the problem at hand by making certain assumptions.

Once the scenario is complete, it is used to facilitate the idea of how a new intelligence process could be used to meet a real-time collection requirement. This new process for dynamic retasking involves many entities. In order to maximize the effectiveness of the dynamic retasking process, active participation by the JFC (Joint Force Commander) and J-2 (Director of Intelligence) staff will be necessary. Their involvement and support of dynamic collection requirements is essential to support the timely fulfillment of such requirements. In addition, a standard procedure must be in place that will facilitate the timely processing of real-time collection requirements and that will ultimately connect the requester of collection support to the actual collector operator. This thesis describes the anticipated responsibilities of the JFC and J-2 as well as provides the structure and definition for a new procedure that may facilitate the timely fulfillment of real-time requirements given certain scenario assumptions.

The current process for collection could be altered in several ways to ensure timely and effective tasking of collection assets. Instituting skip-echelon procedures will reduce the time normally required for requests to travel through the chain-of-command. Combining the functions of the J-2, JRC (Joint Reconnaissance Center), and the JFACC (Joint Force Air Component Commander) into a single entity, called the DRCMA (Dynamic Requirements Collection Management Authority), will facilitate a more timely response to dynamic collection requests. The DRCMA will also provide flexibility during combat by delineating tasking authority to meet the JFC priorities with regard to timeliness and overall effectiveness. This delineation of authority could be exercised through geographical or mission area divisions within the DRCMA to increase timeliness and reduce the possibility of bottlenecks. The timeliness of the DRCMA process also depends on the ability of

requesters to select the most appropriate collector. The Joint Collection Management Tool (JCMT) will support the requester's ability to make a wise selection by providing a model of all the collection assets and information concerning their respective capabilities and availability.

Finally, the long range and long loiter time capabilities of the HAE UAV are balanced against their use for dynamic retasking to support the tactical commander's time-sensitive intelligence requirements. A discussion follows that explores the tradeoffs encountered by using the HAE UAV for such a purpose. The HAE UAV's capabilities may be more appropriately used to fulfill deeper reconnaissance and surveillance missions to support the JFC's theater objectives at the expense of close range dynamic collection needs experienced by field commanders. The HAE UAV combined with the DRCMA process may offer a quick solution to a complex problem, but a more serious look and perhaps a rethinking of the entire concept may be a more appropriate approach for the long haul.

## I. INTRODUCTION

### A. W.W.I ERA

Military planners realized early in World War I that pilotless aircraft could have substantial advantages over the traditionally manned airplanes. Research began at the Ordnance College of Woolwich after the British sustained heavy pilot casualties as a result of the German Fokker. Professor A.M. Low was tasked to design an unmanned aircraft capable of interception and ground attack. Unfortunately, numerous mishaps hampered the British attempt to demonstrate the effectiveness of unmanned aircraft. [Ref. 1: p. 21]

The United States (US) was also conducting experiments with unmanned aircraft. The Navy's efforts led to the first successful flight of a "robot" aircraft on March 6, 1918, when the Curtis flying bomb flew 1000 yards. The Curtis bomb was guided by a preset gyroscope for direction, and a barometer controlled the altitude. Once the aircraft had flown the prescribed distance, the engine would shut off and the bolts holding the wings in place would be mechanically removed. The fuselage and the bomb would then fall to the target. [Ref. 1: p. 22]

The Army explored the possibilities of unmanned flight in a program that created a biplane called the Kettering Bug. Charles F. Kettering led this first successful effort to deliver an explosive to a target with an unmanned aircraft. The Kettering Bug, with a 15 foot wingspan and a 37-hp engine, carried a 180 pound bomb. On its fourth flight, the Kettering Bug flew a specified distance before the controls directed the airplane into a nose-dive directly to the target. However, the war ended less than a month after this flight, leaving little time to exploit its success. [Ref. 1: p. 22]

## B. V-1 BUZZ BOMB

The development of Unmanned Aerial Vehicles (UAV) continued throughout World War II with the introduction of weapons of mass destruction like the German made V-1 Buzz Bomb. The V-1 was guided by an Askania gyroscope that gave it altitude and direction information. A small propeller on the nose of the bomb measured the distance traveled. Once the V-1 traveled the preset distance, the fuel was automatically shut off, allowing the bomb to make a “buzzing” nose dive towards the target below. Even though only 2,500 out of 10,500 V-1s survived their own mechanical failures and the British air defenses, they caused 14,665 casualties. Consequently, the V-1 was one of the most notorious UAVs of World War II. [Ref. 1: p. 27-28]

## C. FIREBEE TO AQM-34

In 1951, Ryan Aeronautical Company produced the first jet engine target drone called the Firebee shown in Figure 1-1. Nine years later, when Gary Francis Powers was shot down in a U-2 during a reconnaissance mission over the Soviet Union, the Firebee went from target drone to reconnaissance asset. The political embarrassment caused by this incident forced the US to cease further manned reconnaissance flights over the USSR

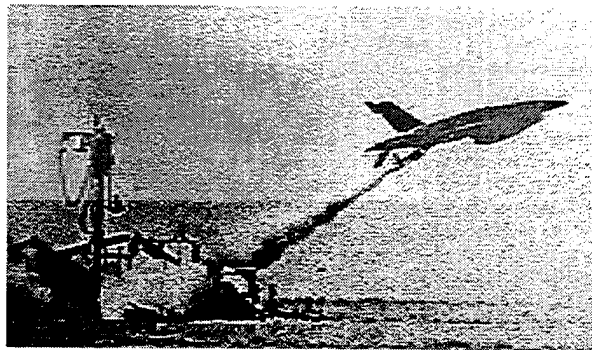


Figure 1-1. Firebee ground launch. From Ref. [1].

using the U-2. This led to a major reconfiguration of the Firebee into the AQM-34 reconnaissance drone. The Teledyne-Ryan AQM-34 was first used for photographic reconnaissance over China in 1964. In 1965, China downed one of the pilotless aircraft. In the years that followed, improved drones were introduced that could fly at higher altitudes and avoid enemy air defenses. [Ref. 1: p. 30-31] This shift to unmanned aircraft allowed the US to continue its critical reconnaissance missions without the political risk or loss of human life.

#### **D. "BUFFALO HUNTER" IN NORTH VIETNAM**

High attrition rates of US aircraft during bombing missions in North Vietnam led to major innovation in the technology and operational usage of UAVs during an operation called Buffalo Hunter. A group of variants of the original AQM-34 flew over 3,000 sorties with missions ranging from target acquisition and damage assessment to electronic surveillance and jamming of enemy radar. [Ref. 2: p. 1-2] Their speed, size, and low altitudes allowed them to effectively avoid enemy defenses, giving the reconnaissance UAVs an attrition rate of only 4% [Ref. 1: p. 31]. During Buffalo Hunter, unmanned aircraft demonstrated their capabilities during an actual conflict.

#### **E. UAVS FOR THE MODERN BATTLEFIELD**

Fortunately, much development and demonstration of UAV capabilities has already been done. UAV technology that has been maturing since World War I was used extensively during the Israeli Operation Peace for Galilee in the Bekaa Valley, and in Iraq and Kuwait during Operation Desert Storm. In both of these operations, UAV technology proved itself in incredible ways. UAVs showed that they were ready to support a variety of different missions on the modern battlefield. Although many UAV accomplishments during these wars were service-specific, the lessons learned from their experience and use can be applied to all future joint operations.

As the military works to create a joint environment for all prospective operations, UAV capabilities will be more appropriately employed to provide benefits for all the services.

One of the major lessons learned from Desert Storm was that intelligence collection assets were insufficient to meet the need [Ref. 3: p. 20]. John Deutch, Deputy Secretary of Defense, said that improvements were needed in "intelligence for military commanders in the broadest sense, whether you are talking about national assets or tactical reconnaissance [Ref. 4: p. 42]." After the war, operational commanders said that they were skeptical of relying too much on satellites for reconnaissance, but there were not many other good alternatives. General John Michael Loh, Air Combat Command, said that the Air Force had not made progress in tactical reconnaissance. When only eighteen RF-4Cs arrived just before the beginning of the air war, it was clear that the Air Force had a low priority on tactical reconnaissance assets [Ref. 5: p. 194-95]. Regardless, the need for near real-time (NRT) tactical intelligence persisted. Admiral Stanley Arthur, commander of the Seventh Naval Fleet and all US naval forces in Central Command during the war, commented, "We found that everybody wanted to know more about what was visually happening on the battlefield than we had assets to do [Ref. 4: p. 42]." NRT imagery of the battlefield was needed to support the commanders in the field, the Joint Force Commander (JFC), and everyone in between.

#### **1. Israeli use of UAVs**

The concept of gathering NRT imagery of the battlefield was validated during the Israeli conflict with Syria in 1982. Israeli-made Scouts, shown in Figure 1-2, and Mastiffs were used in the initial air offensive into Syria. While some of the UAVs were used to identify the Syrian Surface-to-Air Missile (SAM) radar locations and signatures, others were used to transmit



live video of the air attack to the Israeli commander. Israeli Scouts were fitted with TV cameras that provided the commander with live video of the air campaign while he was watching from his ground-based command post. [Ref. 6: p. 22-23] This was a brilliant example of UAVs providing the necessary NRT imagery to support the mission. The US Navy also achieved success when using the Pioneer UAV system during Desert Storm.

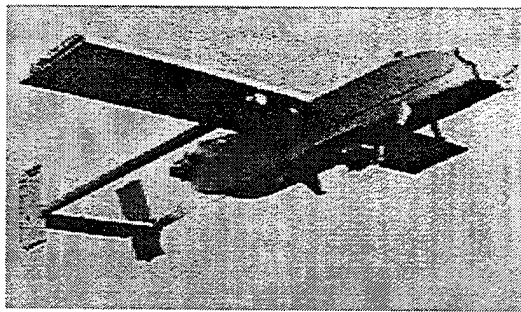


Figure 1-2. Israeli Scout fitted with video camera. From Ref. [1].

## **2. Pioneer in Desert Storm**

The US Navy kept at least one Pioneer UAV, shown in Figure 1-3, airborne at all times during Desert Storm [Ref. 7: p. 45]. During operations Desert Shield and Desert Storm, a total of 523 missions were flown using the Pioneer system, whose primary elements included five UAVs and a ground control station (GCS). Pioneer was effective in accomplishing a variety of missions including surveillance, targeting and gunfire adjustment, and damage assessment. The video information collected by the Pioneer was downlinked to the GCS in NRT. [Ref. 8: p. 4-5] Pioneer superbly demonstrated the value of NRT imagery collection when its video image was used to adjust naval firepower to accurately hit the target [Ref. 9].

In spite of these successes, Desert Storm served as a reminder that NRT imagery is essential to the warfighters, and that the capability to provide such imagery on a large scale is not yet a reality. Even though the capability to meet the warfighter's NRT imagery needs were not fully

realized during the Gulf War, we can be optimistic. History shows that UAVs can provide NRT imagery, but the "intelligence machine" is not yet equipped to provide this level of support to all the warfighters in joint operations.

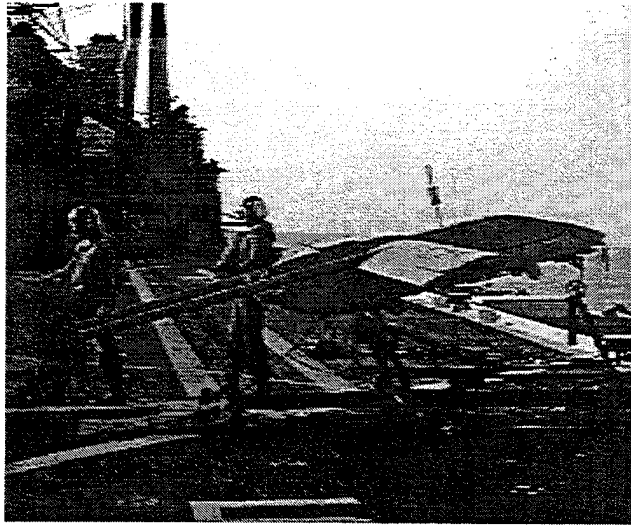


Figure 1-3. Pioneer prepares for launch during a Desert Storm Operation. From Ref. [4].

## F. UAVS FOR TOMORROW

The combination of budget constraints for the Department of Defense (DoD), the continuing development of new and advancing UAV technology, the obvious successes of UAVs in Desert Storm, and other factors have turned many hopeful eyes towards UAVs. The Defense Airborne Reconnaissance Office (DARO) is presently directing a development of UAVs for tomorrow's battlefield that will support all of the services. This development effort includes work done by the Joint Program Office (JPO) and the Advanced Research Projects Agency (ARPA). [Ref. 10: p. 1-1,6] The development effort is focused on providing a family of UAVs to support the warfighter's intelligence needs, each UAV having unique capabilities.

The High Altitude Endurance (HAE) UAV is one of the members of this family and is being managed by ARPA. One of ARPA's objectives is to provide a solution to the problems addressed previously concerning NRT imagery. The HAE UAV aims to support the warfighter's immediate imagery needs through a process called dynamic retasking. Dynamic retasking is defined as the process of altering the HAE UAV's mission plan in real time to satisfy immediate requirements. The problem of getting imagery intelligence to the warfighter in NRT is complex and will not be solved easily, but a process that allows for the effective dynamic tasking of the HAE UAV will certainly reduce the time between the warfighter's request for information (RFI) and the final receipt of that information.

History shows that tactical commanders want NRT imagery to support military operations on the battlefield. History also shows that UAVs have the capability to provide NRT imagery under certain circumstances. This thesis will examine the planned capabilities of the HAE UAV, the current tasking process, problems within that tasking process, and then attempt to describe a process through which tactical commanders may dynamically retask the HAE UAV to satisfy their requirements for immediate imagery on the battlefield.



## II. THE HAE UAV SYSTEM

### A. BACKGROUND

In November of 1993, the Congressional Authorization Conference published a report that stated, "tactical reconnaissance is relatively more important to national security than at any other time in our history" [Ref. 10]. The report also requested that a new approach be taken in the development and acquisition of new tactical airborne reconnaissance systems that would "bring management attention, order, and efficiency." Consequently, the Deputy Secretary of Defense created the Defense Airborne Reconnaissance Office (DARO) to unify current reconnaissance architectures and manage the future acquisition of all joint service and Defense-wide airborne manned and unmanned reconnaissance and surveillance capabilities. [Ref. 10: p. ES-1] Therein lies the great challenge that DARO must face: to develop standard data formats and common tasking strategies for all the disparate systems ranging from the U-2 and its unique tasking, processing, and dissemination architectures to the smallest tactical UAV with its own non-developmental item architectures, while insuring appropriate interfaces with national collection systems to support the warfighter [Ref. 10: p. 1.7-8].

DARO published the Integrated Airborne Reconnaissance Strategy (IARS) to provide visibility into the steps that must be taken to insure that the necessary interfaces and integration become a reality. Figure 2-1 is a visual depiction of IARS and how it will make use of new C4I technologies to support the warfighters' capability to "see" deeper and "hear" more clearly [Ref. 10: p.1-8]. The HAE UAV, shown as "Endurance UAV" in Figure 2-1, will be an integral part of this strategy. (The Tier II Plus and Tier III Minus air vehicles are both part of the HAE UAV system, but for the purposes of this thesis, only the Tier II Plus will be examined.) It will be used in conjunction with other collectors such as joint and tactical manned

reconnaissance platforms as well as tactical UAVs. The IARS is to combine and exploit these collector capabilities and provide the warfighters with the information they need on the battlefield.

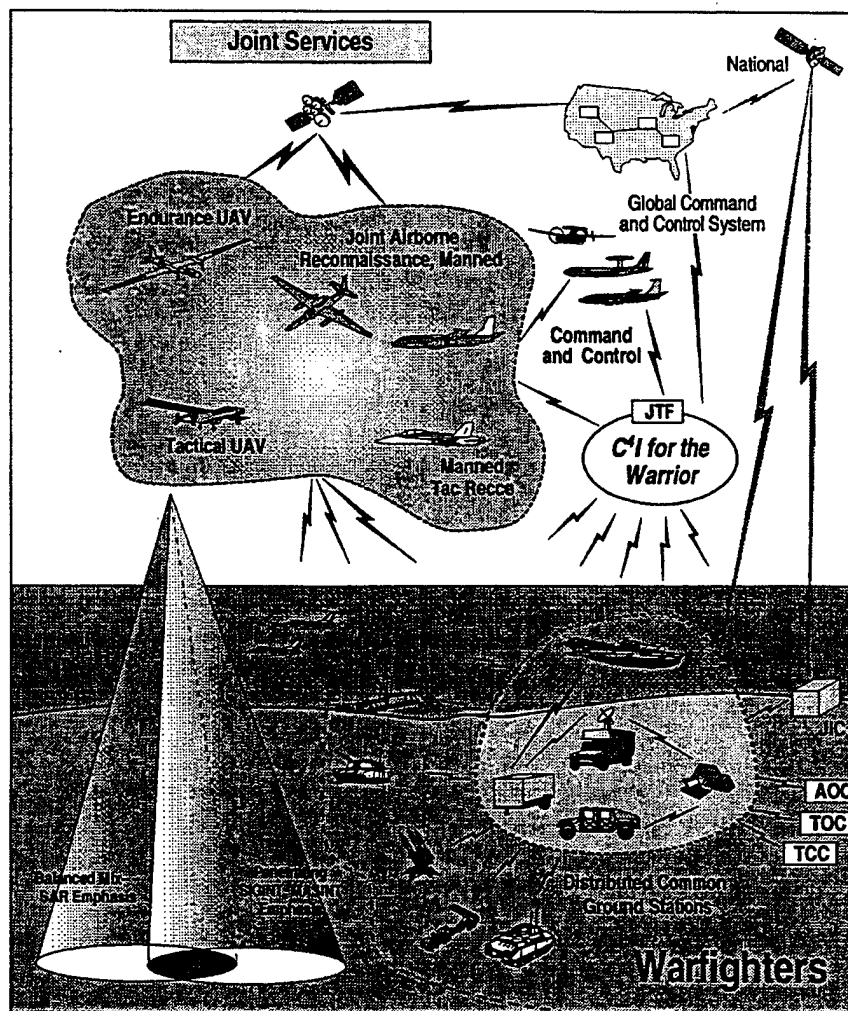


Figure 2-1. DARO's Integrated Airborne Reconnaissance Strategy. From Ref. [11].

The Advanced Research Projects Agency (ARPA) is managing the HAE UAV program under DARO's direction as an Advanced Concepts Technology Demonstration (ACTD). This allows for an accelerated and streamlined development of HAE UAV technology, and provides users with an

understanding of the military utility of the technology before committing to its acquisition. ACTDs are designed to reduce acquisition risks and allow the user to develop Concepts of Operation (CONOPS) while deferring major investment until the technology is mature enough to provide military utility. [Ref. 10: p. 1-4]

The military utility that DARO plans to provide through the HAE UAV is support to combat planning and battlefield execution through extended tactical and theater reconnaissance. This will also be accomplished by providing continuous, all weather, day or night, broad area Reconnaissance Surveillance and Target Acquisition (RSTA) in near-real-time (NRT) to Joint Force Commanders. [Ref. 12: p. 1-1]

## **B. SYSTEM CAPABILITIES**

The HAE UAV system is a multi-purpose, long dwell, broad area theater reconnaissance and surveillance system that will provide enhanced, end-to-end, interoperable, integrated intelligence support to operational commanders [Ref. 12: p. 2-1].

It is designed to provide 24-hour continuous broad area coverage of areas of interest within the entire theater of operations. It will be able to provide RSTA and Battle Damage Assessment (BDA) imagery of areas up to 3000 nautical miles from the base of operations. It will provide imagery with the necessary geolocation accuracy and resolution in a timely manner to operational commanders so as to support real-time combat planning and execution. The air vehicle, shown in Figure 2-2, will employ its suite of sensors, Synthetic Aperture Radar/Electro-Optical/Infra-Red (SAR/EO/IR), to collect imagery of preplanned areas and send imagery directly to combat commanders through line-of-site (LOS) or satellite communications (SATCOM). These links will also support the dynamic retasking of the HAE UAV to image new areas of interest in support of time-critical mission priorities. [Ref. 12: p. 2-1]

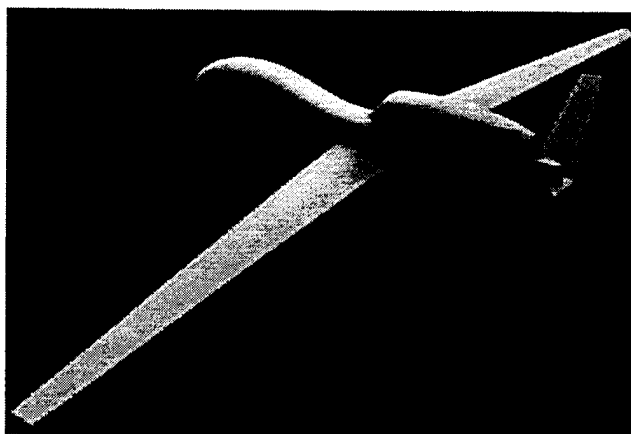


Figure 2-2. Tier II Plus High Altitude Endurance Unmanned Aerial Vehicle. From Ref. [13].

The ability of the HAE UAV to loiter for 24 hours over a single area of interest may give the theater Commander in Chief (CINC) tremendous advantages over previous CINC's. According to John Entzminger, ARPA's director for the HAE UAV program, the theater commander wanted continuous coverage of the Iraqi Republican Guard during Desert Storm. He wanted to know when and if they moved, but the capability was not available. The HAE UAV system will be able to meet needs like this during the next conflict. Its ability to loiter for long periods of time and to provide continuous coverage of a 10-30 kilometer swath gives the HAE UAV unprecedented value. [Ref. 14: p. 40]

The HAE UAV CONOPS contends that the Tier II Plus will be highly survivable for a number of reasons. Its high operating altitude of 65,000 feet will allow it to avoid most enemy air defenses. The Tier II Plus will employ standoff tactics when feasible, and on-board and off-board warning will allow some dynamic threat avoidance. The air vehicle will also have limited on-board electronic counter measures (ECM). [Ref. 12: p. 2-1,4]

The following is a list of key areas that the CONOPS states the HAE UAV be able to support [Ref. 12: p. 2-4,5]:



- **“Stand-off surveillance in peace, crisis, and war.”** The HAE UAV will be able to perform its mission at high altitudes thus reducing the threat of enemy engagement.
- **“Support targeting and Battle Damage Assessment.”** The high resolution sensor capability of the HAE UAV will support precision strikes and enhance a quick restrike capability through NRT BDA.
- **“Support targeting of time critical targets.”** The HAE UAV will allow the NRT observation of dynamic events and provide a means to see time-critical targets through dynamic retasking.
- **“Intelligence preparation of the battlefield.”** The operational range of 3000 nautical miles and the 24 hour loiter capability will allow the HAE UAV to provide continuous coverage of near and far areas of interest. Dynamic retasking will allow for coverage of time-critical areas of interest.
- **“Situation Awareness.”** The combination of long loiter time, broad area coverage, all weather sensors, and a NRT wide communications bandwidth will significantly improve the commander’s sensitivity to ongoing events on the battlefield.

This list highlights some of the possible broad applications of the HAE UAV system, but it is not a complete list. It is important to note that some of these potential applications make reference to the dynamic nature of activity on the battlefield and the need for the HAE UAV to be capable of supporting

dynamic retasking. This thesis will address how the HAE UAV system may be utilized to support these time-sensitive applications.

### C. SYSTEM DESCRIPTION

The complete HAE UAV weapon system will consist of an air vehicle segment, a launch and recovery element (LRE), a mission control element (MCE), a ground communications element (GCE), and a support element (SE). Deployment and logistics support, exploitation and distribution of imagery, storage of data, airspace management and deconfliction, and safety will also be elements essential to successful mission performance. [Ref. 12: p. 3-18-22] Table 2-1 shows a summary of the planned HAE UAV system characteristics.

Table 2-1. HAE UAV System Characteristics. From Ref. [12].

CHARACTERISTIC	HAE UAV TIER II PLUS
Gross Take Off Weight	>20,000 lb.
Mission Duration	24 hours on station
True Air Speed	300-400 knots
Loiter Altitude	50,000-65,000 feet
Operating Radius	3000 nautical miles
Survivability Measures	Threat Warning and limited ECM
Command and Control	UHF Milsat (pri)/Ku band (sec)/CDL
Sensors	SAR: 1 m search; 0.3 m spot EO: NIIRS 6+ IR: NIIRS 5+ Ground Motion Target Indication
Coverage per Mission	40,000 sq. NM. search imagery or 1,900 spot (2x2 Km) image frames
Sensor data transmission	Wide Band Comsat: 1.5-50 Mbits/sec LOS wide band (CDL): 137 Mbits/sec
Data Exploitation	Existing and Programmed: JSIPS, CARS, ETRAC/MIES, JICs, CIG/SS, NPIC

## **1. Air Vehicle Segment**

It is anticipated that a deployable air segment will include four Tier II Plus and two Tier III Minus vehicles, however, this thesis will focus on the operations of the Tier II Plus only [Ref. 12: p.3-5]. The air vehicle segment will include components such as sensor payloads, avionics, SATCOM (satellite communication) and LOS datalinks. The sensors that will be carried are SAR, EO, IR, and Ground Motion Target Indication (GMTI). The EO and IR sensors have an objective National Imagery Interpretability Rating Scale (NIIRS) of 6+ and 5+ respectively. The air vehicle will be fully autonomous during take-off, flight, and recovery and will not require man in the loop remote piloting during the mission, however, the vehicle will be responsive to remote piloting when dynamically retasked to support time-critical requirements. [Ref. 12: p. 2-5]

Command and Control (C2) of the air vehicle will be perfumed using ultra high frequency (UHF) Milsat as the primary means, and a Ku band SATCOM link as a redundant method for over-the-horizon (OTH) communications. The UHF system will be a full duplex link. C2 will be performed using the Common Data Link (CDL) for LOS communications within range of the MCE. [Ref. 12: p. 6-2]

Sensor data transmission will be sent via commercial satellite such as PANAMSAT or INTELSAT when the air vehicle is operating OTH. This will be a simplex link only. When the vehicle is operating within LOS, the CDL will be used. Although the HAE UAV will have the capability to transmit data at a maximum rate of 137 Mbits/s for LOS communications, not all users will be able to receive at this rate. [Ref. 12: p. 6-2]

## **2. Launch and Recovery Element**

The LRE will be responsible for preparation of the HAE UAV for launch, launch of the air vehicle, and recovery of the vehicle after mission

completion. The LRE will pre-flight the air vehicle and verify the status of the onboard systems prior to launch. Before launch the LRE will receive the mission plan electronically from the MCE and then load the plan into the HAE UAV. During launch, the LRE will control the air vehicle and coordinate with local air traffic control before handing off the vehicle to the MCE. During recovery, the LRE will monitor or control the UAV while coordinating with local air traffic control. [Ref. 12: p. 3-9,10]

### **3. Mission Control Element**

Once airborne, the MCE will be responsible for the air vehicle. These responsibilities include sensor control, flight control, and mission planning. According to the CONOPS, the MCE will have the ability to dynamically retask the HAE to perform time critical missions in accordance with established priorities. A total of three HAE UAVs may be retasked simultaneously, although sensor data can only be received by one air vehicle at a time. The MCE will be able to receive sensor data from the HAE at the maximum rate of 137 Mbits/s, and then send the data to exploitation centers or store it for up to 24 hours. [Ref. 12: p. 3-10]

The MCE will be the primary control node that allows battlefield commanders to get the information that they need in NRT. This will be facilitated by the MCE's ability to dynamically retask the HAE UAV to accommodate changing priorities. Dynamically retasking may involve changing the sensor's area of interest, or it may mean that the MCE directs the HAE UAV to a different location. Additionally, the MCE will be capable of providing operational commanders with "quick look" voice or tactical reports via Trojan Spirit and Defense Integrated Secure Network (DISN) in response to tactical requests. [Ref. 12: p. 3-10,18]

#### **4. Ground Communication Element**

The GCE will consist of all the ground equipment necessary to maintain secure communications with the HAE UAV. The components will include a 6m dish antenna for the Ku-band earth terminal and a Modular Interoperable Surface Terminal (MIST) with 2m X-band antenna for the CDL. The GCE will support voice and data communication for tasking and mission coordination and will receive information from existing intelligence systems (e.g., Tactical Reconnaissance Intelligence Service (TRIXS), Tactical Information Broadcast Service (TIBS), and Tactical Receive Equipment and Related Applications (TRAP)/Tactical Data Information Exchange (TADIX-B)). These communication links will support HAE UAV mission operations and activities such as the receipt of tasking, mission coordination, imagery dissemination, and dynamic threat avoidance. [Ref. 12: p. 3-10,11]

#### **5. Support Element**

The support element consists of all the necessary support personnel and equipment to maintain and operate the HAE UAV system. This includes maintenance personnel, spare parts, power generators, maintenance vans, trailers, test equipment, and tools. Maintenance manpower will support a four hour turnaround for the air vehicles and provide corrective and preventative maintenance for all HAE UAV system components. [Ref. 12: p. 3-11]

#### **D. MISSIONS AND TASKS**

According to the CONOPS, the HAE UAV will be a valuable part of DARO's Integrated Strategy for Airborne Reconnaissance during times of peace, for military operations other than war, during regional crisis and limited deployments, and for forward deployed wartime operations. Used in conjunction with other RSTA platforms such as JSTARS, the U-2, Guardrail, and other short and medium range UAVs, the HAE UAV will act as a force

multiplier. In addition to the potential applications listed previously, the CONOPS also suggests the following list as possible applications of the HAE UAV system: [Ref. 12: p. 3-1,2]

- **“Near real time (NRT) targeting and Precision Strike.”**

The HAE UAV will be able to monitor real time events and locate and identify mobile targets with its precise sensors and then relay this information to commanders in NRT. This will shorten the targeting cycle and allow for more accurate targeting of time critical targets. The HAE UAV's sensors will also provide the resolution necessary to use precision guided munitions to improve battlefield efficiency.

- **“NRT combat assessment.”** The HAE UAV will provide commanders an on-going view of the battlefield and will allow for combat assessment of planned and executed operations in NRT.

- **“Wide area surveillance.”** The HAE UAV will provide high resolution imagery of large areas (40,000 NM<sup>2</sup>) deep into enemy territory for long periods of time.

- **“Sensitive Reconnaissance Operations.”** The HAE UAV will be able to perform missions that could not normally be done by manned aircraft due to significant military or political risks.

- **“Enemy order of battle information.”** The HAE UAV will allow for a quick means to track enemy order of battle information, including areas where there is not much information available.
- **“Blockade and Quarantine Enforcement.”** The HAE UAV will support economic, military, and drug enforcement blockades as well as quarantine missions to free up patrolling assets for other activities.
- **“Humanitarian Aid.”** The HAE UAV will be able to survey damage caused by natural disasters and support other humanitarian aid operations.

This is not a complete list of possible areas where the HAE UAV could add value to military operations. The services are interested in using the HAE UAV for other purposes. The Air Force is exploring the possibility of integrating the HAE UAV into a plan called “closed-loop precision strike.” During Desert Storm, some targets were hit several times because it was uncertain if the target had been destroyed during previous attacks. In “closed-loop precision strike,” the Air Force could use the HAE UAV to monitor an air strike and then provide immediate feedback to the operators concerning the effectiveness of the attack. This could reduce the use of unnecessary munitions and enhance the efficient use of attack aircraft. [Ref. 16: p. 25]

## E. IMAGERY TRANSMISSION

### 1. Line-of-sight High Data Rate Imagery

Figure 2-3 shows how the HAE will have the capability to transmit sensor data at a rate of 137 Mbits/s through the CDL in accordance with the requirements stated in the "System Capability Document for the Common

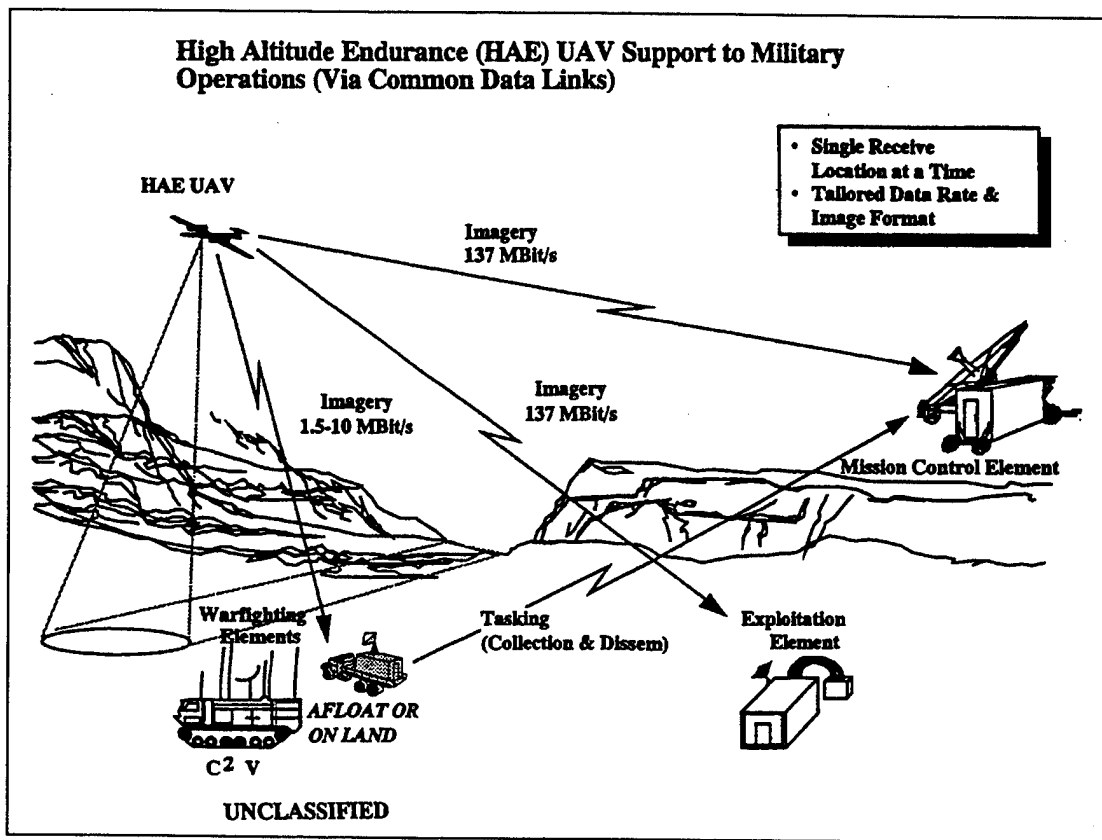


Figure 2-3. LOS imagery transmission strategy. From Ref. [12].

Data Link - Class 1, Document No. 7681990" [Ref. 15: p. 1.0a]. This will be a full duplex link. 137 Mbit/s is the maximum rate at which data can be transmitted. The LOS mode of operations allows for the greatest amount of data transmission. The MCE is capable of receiving the data at that rate as well as other theater exploitation sites that might want the data. However, most users in the field are currently not capable of receiving data at such a



high rate. Most of these tactical users will have communications equipment that is limited to T-1 data rates at best. This means that tactical users will only be able to receive that data at rates from 1.5 to 10 Mbits/s. [Ref. 12: p. 6-2]

## 2. Long Haul High Data Rate Imagery

SATCOM will be necessary for OTH imagery transmission, as shown in Figure 2-4. Any satellite which operates in the Ku commercial band can be a candidate for use. Primary candidates include PANAMSAT and INTELSAT. Because of the data rate limitations imposed by these and other

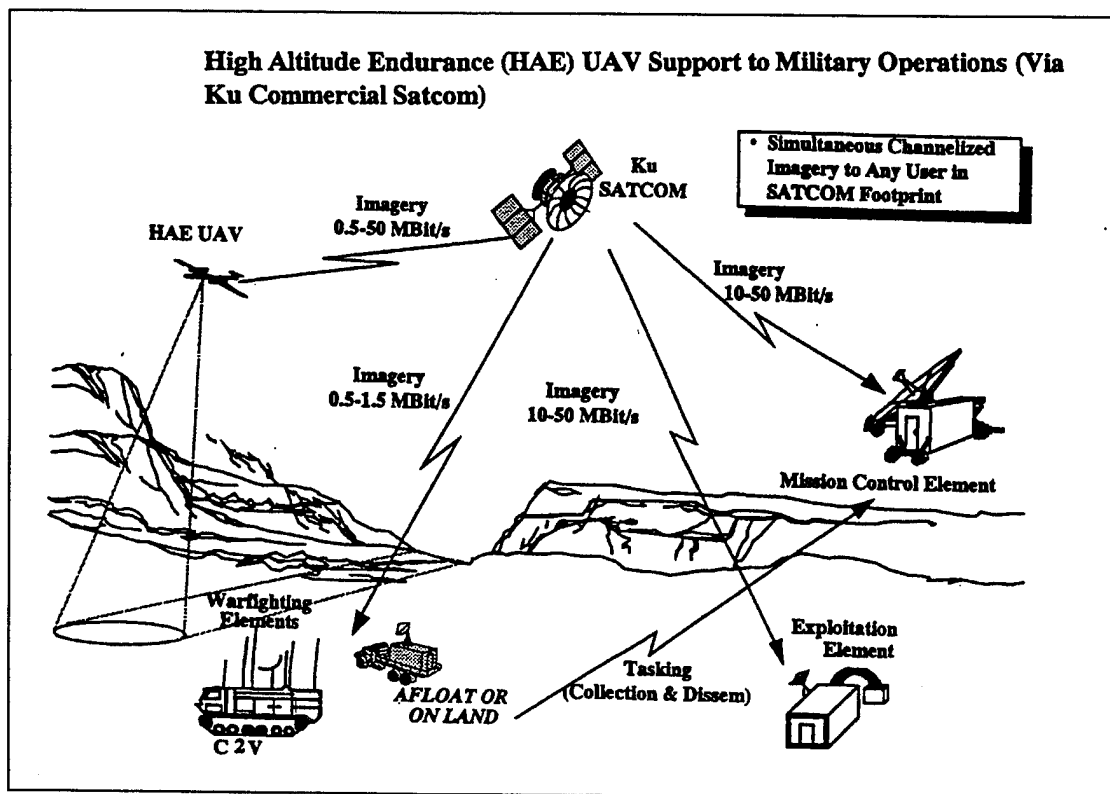


Figure 2-4. SATCOM imagery transmission strategy. From Ref. [12].

Ku-band satellites, the maximum data rate of 137 Mbits/s will not be possible in this mode of operation. It is anticipated the maximum data rate that will be achievable through SATCOM will be 50 Mbits/s with a minimum of 10

Mbits/s. The MCE and other capable exploitation sites will be able to receive data at these rates. However, most tactical field users will be limited to reception at T-1 data rates. This challenge may be overcome if all data is first passed through the MCE and then to tactical users, but this may not meet the requirements of a time-critical situation. [Ref. 12: p. 6-2]

## **F. EXPLOITATION**

HAE UAV imagery will be exploited primarily through existing exploitation centers and systems. These exploitation sites include the Common Imagery Ground/ Surface Station (CIG/SS), Contingency Airborne Reconnaissance System (CARS), Enhanced Tactical Radar Correlator (ETRAC), Modernized Imagery Exploitation System (MIES), Joint Services Imagery Processing System (JSIPS), and the National Photographic Interpretation Center (NPIC). HAE imagery may also be exploited in the theater Joint Intelligence Centers (JICs). Interfaces and communication links between the MCE and exploitation sites must still be defined. [Ref. 12: p. 3-19]

## **G. COMMAND AND CONTROL**

The way in which the HAE UAV system integrates into the command and control structure will have a definite impact on its mission performance. The command and control structure described herein is taken from the HAE UAV CONOPS and provides an early discussion of how command and control might work if the HAE UAV is operationally employed. It aims to maximize the operational utility of the HAE UAV within existing theater command and control structures [Ref. 12: p. 4-1].

United States Atlantic Command (USACOM) will have Combatant Command over all HAE UAV assets. Air Combat Command, the air component of USACOM, will exercise operational control (OPCON) over all HAE UAV assets during peacetime operations. Such operations include

training and exercises. Theater CINC's who want to use the HAE UAV system must issue a request to the Joint Chiefs of Staff (JCS). The JCS may approve the request based upon coordination with USACOM/ACC and availability of HAE UAV assets. An HAE UAV attachment will then be deployed to support the CINC. During exercises, the deployed HAE UAVs will fall under the exercise command structure. [Ref. 12: p. 4-1]

During contingency or support of wartime operations, HAE UAV detachments will fall under the command of the Unified CINC's. CINC's will have full OPCON of the HAE UAV detachment during their employment or deployment. Consequently, all HAE UAVs will be considered theater assets to be used to support the theater CINC or Joint Force Commander (JFC). [Ref. 12: p. 4-1,2]

#### **H. TASKING**

The theater J-2 assigned by the JFC will be responsible for the collection management of the HAE UAV system. This will involve accepting all Requests For Information (RFI), prioritizing these requests based on the JFC's objectives, and defining reporting requirements. The J-2 and his staff will make recommendations concerning mission and target priority for reconnaissance assets. RFIs will be handled using the existing architecture for collection management and will be prioritized by the J-2 based on the CINC's essential elements of information (EEI). The J-2 will also be responsible for managing the exploitation, production, and dissemination of all the intelligence collected by the HAE UAV. [Ref. 12: p. 4-2,3]

Once the J-2 has fulfilled these responsibilities, the Joint Force Air Component Commander (JFACC) will schedule sorties for the HAE UAV based upon the requirements given him by the J-2. The JFACC will be responsible for integrating the HAE UAV into the Air Control Plan (ACP) so as to deconflict manned and unmanned operations in the same airspace. All

HAE UAV sorties will be tasked in accordance with the Air Tasking Order (ATO). [Ref. 12: p. 4-2]

Although a possible process for tasking has been described here in brief, there are concerns about the efficiency of such a process, especially when time is the critical factor. How the HAE UAV will be tasked to meet *dynamic* collection requirements is still in question. This section has described a tasking process, according to the CONOPS, that is not specifically designed to support dynamic collection requirements. Chapter III will describe this normal tasking process according to the joint doctrine stipulated within the joint publications. Chapter VI will describe a process designed specifically to support dynamic collection requirements.

Even though normal collection management processes did not meet the warfighter's dynamic needs during Desert Storm, there is optimism that the HAE UAV may bring a new capability to the battlefield that will help to solve some of these problems. (Flaws in the tasking process that surfaced during Desert Storm will be discussed in more detail in Chapter IV.) How the HAE UAV will be dynamically retasked at tactical levels in a joint operating environment is at the heart of this problem.

The multi-user, multi-purpose, large volume collection characteristics of the HAE UAV program combined with the commitment to provide exploitable imagery to theater intelligence centers, selected imagery to operations centers, and direct dissemination to tactical elements makes mission management a serious challenge [Ref. 12: p. 3-12].

Meeting this challenge with success may be a formidable task, but the HAE UAV appears to offer a way to help satisfy the NRT imagery needs of warfighters on the battlefield. Before a clear judgment can be made about the ability of the HAE UAV to support its claims, it will be necessary to examine how tasking and collection management works within the intelligence cycle. Chapters III and IV will provide this kind of examination

and bring to light some deficiencies associated with the intelligence and collection management process.

It will also be important to understand what kind of NRT imagery needs the tactical commander may experience in combat. It would be very difficult, if not impossible, to describe the *typical* scenario in which a commander on the battlefield finds himself in need of NRT imagery. Chapter V will attempt to describe a *probable* scenario in which a tactical commander requires NRT imagery. Once these ideas have been fully developed, it will be possible to draw conclusions on how the HAE might be integrated into the "intelligence machine" and what streamlined process will allow for the most timely dynamic retasking. It will also shed light on whether the HAE UAV is the most appropriate platform for meeting tactical commander's NRT imagery needs.



### III. COLLECTION MANAGEMENT FOR JOINT OPERATIONS

#### A. INTELLIGENCE CYCLE

The process that occurs when a tactical commander makes a request for imagery intelligence and then receives the final intelligence product is not a simple one-for-one exchange. The process, known as the intelligence cycle and shown in Figure 3-1, involves several steps that must be fulfilled before the process is complete. In most circumstances, all the steps must be taken so that the final product is useful to the original requester. The steps necessary to complete the intelligence cycle are planning and direction, collection, processing, production, and dissemination. This thesis is focused on the tasking activities that occur during the planning and direction, and collection phases of the process. These steps occur at the front end of the intelligence cycle, but they can be better understood in the context of all the other activities that must occur during the entire cycle. This section will provide the reader with a basic understanding of the steps necessary to turn a request for information (RFI) into a useful intelligence product. The cycle will be described within the context of providing intelligence support to joint operations and will be written in accordance with Joint Publication 2-0, *Joint Doctrine for Intelligence Support to Operations* [Ref. 17].

##### 1. Planning and Direction

During this first step of the intelligence cycle, the commander's guidance and strategic objectives are defined. Based on these factors, essential elements of information (EEI) will be defined and a collection plan will be developed. EEIs are defined as the "critical items of information regarding the enemy and the environment needed by the commander by a particular time" to assist him in reaching logical decisions [Ref. 17: p. GL-9]. In the case of joint operations, the Joint Force Commander (JFC) or theater

CINC will be responsible for determining the EEIs and directing the development of the collection plan. It is also the time when the command relationships are defined between all the participating intelligence elements within the joint force. Procedures should be established for dissemination among superior, lateral, and subordinate intelligence organizations. The level of support required from national intelligence organizations will be defined as well. [Ref. 17: p. II-4,5]

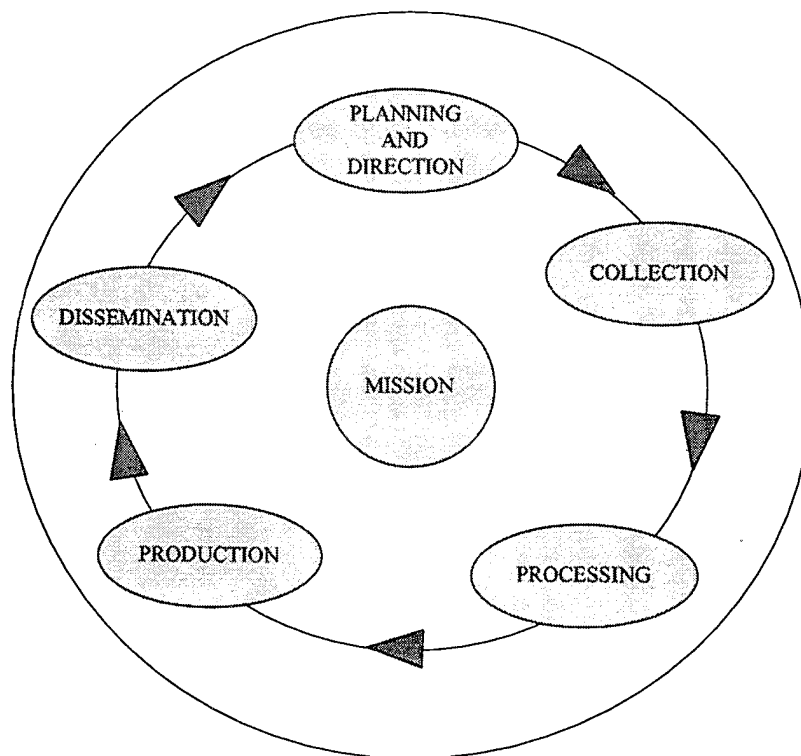


Figure 3-1. The Intelligence Cycle. After Ref. [17].

All requests for information originating from the various sources within the joint force will be registered, validated, and prioritized for the appropriate collection, processing, production, and dissemination through a process called Collection Requirements Management (CRM). See Figure 3-2 for the definition of CRM according to Joint Pub 2.0.



CRM activities include the prioritization of the requirements in accordance with the collection plan to support the intelligence needs of component commanders and the joint commander. CRM processes then transform these requirements into tasking for the appropriate organic, attached, and supporting forces. Organic intelligence assets are those permanently assigned to the requesting activity's command; attached assets are assigned to the joint force to support specific operations; supporting assets are from other theaters or areas of responsibility (AOR) that are tasked to support the joint force commander within his AOR. Throughout this entire phase, the evaluation of the collection strategy and the assessment of its effectiveness to meet ever-changing intelligence needs are performed through CRM. [Ref. 17: p. II-4,5]

**Collection Requirements Management (CRM)** - The authoritative development and control of collection, processing, exploitation, and/or reporting requirements that normally result in either the direct tasking of assets over which the collection manager has authority, or the generation of single-discipline tasking requests to collection management authorities at a higher, lower, or lateral echelon to accomplish the collection mission.

**Collection Operations Management (COM)** - The authoritative direction, scheduling, and control of specific collection operations and associated processing, exploitation, and reporting resources.

Figure 3-2. CRM and COM definitions. [Ref. 17: p. GL-6]

## 2. Collection

The collection phase of the intelligence cycle involves the physical acquisition of raw information from many sources such as human intelligence (HUMINT), signals intelligence (SIGINT), and imagery intelligence (IMINT) such as planned to be provided by the HAE UAV. It also involves passing this information to the necessary processing elements. In order to satisfy the intelligence needs of operations, joint force collection management must be

able to task all collection assets within the joint force, and also obtain support from theater and national assets. These assets will be tasked to support the intelligence requirements of all command levels within the joint force. More than one asset may be used to satisfy a particular requirement in order to insure that the information collected is accurate, and to allow for redundancy if one of the collection methods fails. [Ref. 17: p. II-5,6] The next section will give a more detailed description of the collection management process.

The J-2, the Director for Intelligence on the joint staff, is responsible for identifying the intelligence deficiencies, turning these into matching requirements, tasking the appropriate collection assets, and ensuring that processing, production and dissemination occur. The J-2 will rely on the JFC's pre-determined EEIs to accomplish this. It is also essential that the J-2 and all other senior intelligence officers in the joint force understand the requirements of higher, lower, and adjacent command levels to allow for the most efficient collection of information. Having knowledge of the other command level's requirements may prevent redundant RFIs. For example, if a division commander is aware that his corp commander requires collection of an activity of similar interest, then the division commander may not need to submit a redundant RFI for the same information. The J-2 must also understand the capabilities and limitations of the collection assets available to him so that he can make accurate assessments of the lead-time necessary to task, process, and produce intelligence. This will allow the J-2 to satisfy requirements efficiently without wasting collection assets on requirements that cannot be fulfilled in time to satisfy the request. [Ref. 17: p. II-6]

Operations personnel are also involved in the collection phase of the intelligence cycle. Once requirements have been identified, consolidated, prioritized, and tasked against the appropriate collectors during CRM, the actual direction of collection operations is performed by operators during

Collection Operations Management (COM). [Ref. 18] Following COM, the information is collected during mission execution by the operators. According to Major Marshall, author of *Near-Real-Time Intelligence on the Tactical Battlefield*, these collection efforts should be coordinated among the services and intelligence agencies to stimulate cross-cueing and reduce the duplication of effort. [Ref. 19: p. 11] The J-2 must act as the liaison among these various intelligence elements to insure that the necessary coordination occurs within the joint force.

### **3. Processing**

Once information has been collected, it must be processed into a format that can be analyzed by intelligence personnel. Examples of processing include document and communications translation, film processing, and signal processing [Ref. 19: p. 11]. This may require format conversions, the use of computer applications, printing, and video production [Ref. 17: p. II-7]. In the past, processing time greatly increased the time required to get an intelligence product to the original requester. The explosion of technology in the areas of computing, electro-optics, and communication systems has significantly reduced the processing time needed to provide some intelligence products. [Ref. 19: p. 11] However, processing time still creates limitations on the ability of the intelligence system to satisfy real-time intelligence requirements.

### **4. Production**

During the production phase, processed information derived from single or multiple sources must be analyzed, evaluated, interpreted, and integrated into a single product for the consumer. This may involve utilizing information from existing data bases, using data that has just been collected and processed in real time, or both. The analyst responsible for the production of a particular product must be aware of who will use the

intelligence and for what purpose. This will allow the analyst to eliminate unnecessary information and to tailor the intelligence to meet the commander's specific needs. The analysts must also be objective and unbiased during their analysis. If information from different sources is conflicting, the differences must be resolved. If the differences can not be resolved, the commander must be made aware of the uncertainties. [Ref. 17: p. II-8]

During joint operations, the J-2 will coordinate production activities from national to tactical levels. This will prevent unnecessary duplication of effort and allow for mutually supportive production. The J-2 must also identify those organizations that are capable of contributing to the production effort, and ensure that the JFC gets the intelligence products and services that he needs. [Ref. 17: p. II-9]

The final intelligence product should integrate collected information with previously collected information from all sources to provide the commander with an overall picture. The analyst should develop this "overall picture" based on his knowledge of enemy doctrine, strategy, tactics, and equipment, the current situation, and the commander's immediate and strategic objectives. The true value of the intelligence product will not be a measure of the amount of intelligence provided, but its ability to support the commander's capacity to plan and make decisions regarding combat operations. [Ref. 19: p. 12-13] In a time-sensitive situation, the value of the intelligence product may be lost if it does not support the commander's timeline. Consequently, the time required during the production phase creates serious challenges to meeting the dynamic requirements on the battlefield.

## **5. Dissemination**

Dissemination is the final phase of the intelligence cycle. It is during this phase that the cycle is completed and the original requester receives the intelligence in a suitable form that supports his RFI. There are many ways that intelligence can be disseminated and the intelligence producer must consider the needs of the user when determining how to disseminate the final product. Some examples of disseminated products are verbal reports, printed documents, photographs, video tapes, and viewgraphs. The means by which these products can be disseminated are physical transfer, fax transmissions, video-teleconferencing, telephones, data transfer through computer networks such as the Joint Deployable Intelligence Support System (JDISS), briefings, and tactical radio and satellite broadcasts such as the Tactical Information Broadcast Service (TIBS) and the Tactical Related Applications (TRAP) broadcast. The last method is especially useful to provide tactical commanders with time-sensitive intelligence. [Ref. 17: p. II-10,11]

Joint doctrine stipulates that a "push-pull" methodology should be applied during the dissemination process. This will allow commanders to "pull" only what intelligence they need to support operations and allow higher echelon commanders to "push" intelligence that they think is critical to the lower echelons. JFCs should ensure that critical, time-sensitive intelligence is available from adjacent and higher commands through the "push-pull" process to support joint force operations. The dissemination phase of the intelligence cycle must be continuously reviewed to ensure the needs of the joint operation are being fulfilled. [Ref. 17: p. II-11]

## **B. THEATER COLLECTION MANAGEMENT**

Collection management involves all the phases of the intelligence cycle. It is a continuous and iterative process. Collection management is defined as "the process of converting intelligence requirements into collection

requirements” and tasking the appropriate collection sources to satisfy the intelligence needs [Ref. 17: p. GL-6]. This thesis is concerned with the idea of dynamic retasking within the theater, how it works, and if it can be made to work better through the use of the HAE UAV. This section will focus on the areas of collection management that involve the various aspects of tasking. This will include all the steps of the process beginning when a requirement is realized at a tactical level and ending with the actual tasking of the appropriate collection asset. The focus will be on how the RFI flows through the system. The procedure and the entities involved in the tasking process will be identified. For the purposes of this thesis, the RFI will be initiated within an Army division and will be followed through to the actual mission execution by collector operators.

The first three steps in the collection management process for this example will occur within the Army’s infrastructure. Army Field Manual (AFM) 34-2 *Collection Management and Synchronizations Planning* describes in detail the steps and processes involved in collection management within the Army. Figure 3-3 shows the collection management functions and process as depicted by AFM 34-2. The next three sections will describe collection management from an Army perspective and will focus only on the first three steps of the cycle. At the completion of step three, task or request collection, the RFI will flow out of the Army’s infrastructure into the joint command infrastructure. At this point, joint publications will be the primary reference for following the RFI’s activity.

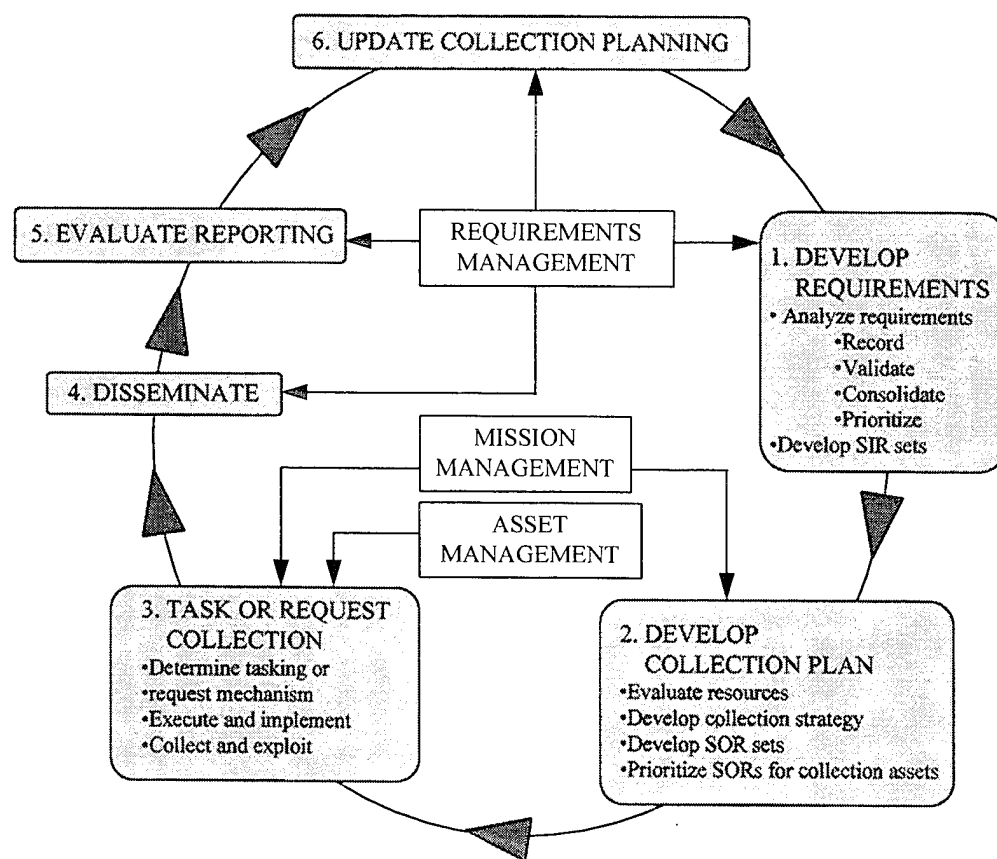


Figure 3-3. Collection Management functions and processes. After Ref. [20].

## 1. Develop Requirements

The identification, prioritization, and refinement of uncertainties concerning the threat and the battlefield environment that a command must resolve to accomplish its mission. [AFM 34-2]

This first step in the collection management process is to develop requirements. The commander must assess the battlefield environment and make decisions about what information he needs to accomplish his objectives. To complete this step, he must provide answers to three questions: *what* must be collected, *where* it must be collected, and *when* it must be collected. The commander must create a prioritized list of needs that will answer these questions for each need. [Ref. 20: p. 3-1,3]

As an example of this first step of the collection management process, consider an army commander who will generate questions that need to be answered. These questions will depend largely on the situation in which the commander finds himself. For this example, consider a commander who has communicated with higher and lower echelons and determines that he needs to know the following information: Will a given enemy tank division counterattack through a particular zone on the battlefield? Is the enemy defending a certain region with less than a battalion? When will another enemy tank regiment counterattack in a specific area? These questions may be designated as Priority Information Requests (PIR) or Specific Information Requirements (SIR) by the commander and may be listed in an order that reflects their relative priority. [Ref. 20: p. 3-2,3]

The commander will not have to make these decisions without adequate support. Army intelligence officers at the division level of command (G-2) will provide support to the commander in a number of ways. G-2s will coordinate the intelligence effort by identifying requirements based on the commander's guidance and concepts of operation. G-2s will also provide the commander with information regarding weather, terrain, and the enemy. They will use their intelligence skills to reduce uncertainties on the battlefield and provide the commander with critical intelligence. G-2s will also be familiar with the enemy so that they can provide the commander with information on patterns of enemy activity and reveal indicators which may help to identify requirements. [Ref. 21: p. 2-3] G-2s will provide the commander with information regarding collection assets as well. For example: if the commander identifies a requirement that demands the use of non-organic collection assets, then the G-2 will inform the commander of the ramifications of such tasking (in this example, the flow of the RFI for non-organic support will be described). [Ref. 20: p. 3-4]



Once the requirements have been identified, they must be analyzed. Analysis will help to determine the best way to satisfy each requirement and may reveal that some requirements can be satisfied with existing intelligence without collection. The steps of analysis are record, validate, consolidate, and prioritize requirements. [Ref. 20: p. 3-4-7]

- **Record Requirements** - Register all requirements from higher headquarters, adjacent, and subordinate units with those within the command.
- **Validate Requirements** - Ensure that all requirements are feasible. If a requirement is not feasible, provide feedback to original requester. Ensure that there is justification for the requirement and identify who needs the results. Check immediate data bases for intelligence that might satisfy the requirement to avoid unnecessary collection.
- **Consolidate Requirements** - Merge similar requirements without losing traceability to all the interested parties.
- **Prioritize Requirements** - Arrange the requirements in an order that will best satisfy the command's mission and objectives. This order may be affected by the time-sensitivity of specific requirements and by the commander's designation of PIRs. PIRs are requests deemed mission essential, that when left unanswered could endanger mission accomplishment.

The final step in the requirements development phase is to develop SIR sets. SIRs take a requirement and break it into smaller, more detailed questions. These questions, when answered, provide the information needed to satisfy the overall intelligence requirement. [Ref. 20]

## **2. Develop Collection Plan**

The integrated and synchronized plan that selects the best collector to cover each requirement. It is a graphic representation of the collection

strategy. This is the first step in the collection management process that involves mission management. [AFM 34-2]

The purpose of this phase of the cycle is to create a collection strategy that will employ collection assets to satisfy the command's intelligence requirements in the most effective and efficient manner. The goal is to synchronize the collection effort by using collection assets in the right place at the right time on the battlefield. Failure to complete an adequate collection plan could lead to a false picture of the battlefield created by using an inappropriate collector or a true picture of the battlefield, but one collected too late to be of any value. [Ref. 20: p. 3-9-10]

The first step in developing a collection plan is to evaluate the collection resources in terms of availability, capability, vulnerability and performance history. The G-2, as the collection manager, must always be aware of the availability of collectors. He will primarily be concerned with organic collectors, those within his echelon of command, but it is also important that he know what non-organic assets are available to complement organic collection capabilities. The G-2 must also be knowledgeable of organic and non-organic collector capabilities. Range, technical capabilities, loiter time, geolocation accuracy, sensor capabilities, and reporting timeliness are all factors that the G-2 must consider. The G-2 will also need to assess the threat to the collector and its corresponding vulnerability within the area of interest. Finally, the G-2 should rely on his previous experience to determine which collectors have performed well in the past. Continued responsiveness, accuracy, and timeliness over a period of time may increase the G-2s confidence in a particular collector's ability to meet the commander's intelligence requirements. [Ref. 20: p. 3-10-11] This factor may very well influence the collection manager's decisions the most.

The next step is to develop the actual collection strategy. During this phase the collection manager will select the resources that he plans to utilize

for collection. For organic assets, he will be able to *task* them directly. He may *recommend* tasking to subordinate echelons, and he may *request* support from higher headquarters. AFM 34-2 concedes that organic assets are usually more responsive, but it warns collection managers not to depend solely on them for intelligence and collection support. In some cases non-organic collectors may be more capable. [Ref. 20: p. 3-11] Synchronization is also a part of developing the collection strategy. During synchronization, the collection manager starts at a point in time when the commander needs the intelligence and plans backwards to allow time for dissemination, analysis, processing, collection and tasking. In this way, he can synchronize all the operations that must occur prior to the final receipt of the intelligence. [Ref. 20: p. 3-14-16]

The final step is to develop Specific Order Requests (SOR) sets. SORs are derived from the SIRs developed during requirements development. SIRs are the detailed questions that must be answered to support the commander's objectives. SORs transform the SIR questions into tasking orders for the collectors. SORs must be specific without being overly restrictive. This allows collectors the flexibility to report information that was not anticipated. SORs must also be prioritized and tailored to accommodate the chosen collection system. [Ref. 20: p. 3-16]

The following example illustrates the need for the development of a collection plan. A hypothetical corps commander's primary concern is detecting and tracking an enemy tank regiment, which poses as the principal counterattack threat. This same corps has priority for an upcoming JSTARS mission. The corps mission manager wants to use JSTARS' wide area surveillance capabilities to identify and follow armor movements and also use preplanned problem sets of national imagery systems to see major choke points along probable enemy tank regiment approach paths. He also prioritizes corps HUMINT requirements to emphasize the collection of

information regarding enemy reconnaissance activity from enemy prisoners of war or refugees. A collection plan is necessary to coordinate all of these collection activities to insure that they are synchronized to support the most effective collection effort. [Ref. 20: p. 3-7]

### **3. Task or Request Collection**

Implementation of the collection plan through execution of system-specific tasking or request mechanisms. [AFM 34-2]

Tasking occurs when the order is actually levied against the collector prior to mission execution. An example of this step might be when the collection manager uses a multiple assets tasking message (MATM) format for IMINT tasking of the JSTARS. Optimum tasking takes place when the collector clearly understands what to do upon receipt of the request. This can be accomplished when the proper message format is used by the requester and all the necessary data fields are complete. There are a number of formats and procedures that the collection manager must be able to use in order to task the various collectors. These formats and procedures will vary based upon the commander's need to use organic or non-organic collection assets. If the assets required are organic, that is within his command, then he may task them directly. If the assets are not organic, then he must submit his request to the next level of command. Before submitting his request, the G-2 must be familiar with the different tasking formats for the distinct collection systems and the agencies that control them. [Ref. 20: p. 3-17,18]

Depending upon the collection requirement, national, theater, or echelons above corp (EAC) collection assets may be necessary. For support from national or EAC systems, Defense Intelligence Agency Manuals (DIAM) define the required procedures and request formats. [Ref. 20: p. 3-17,18] For our example, we will assume that the request is submitted for support from a

theater collection asset, such as the planned HAE UAV. In a joint operation, the request must flow from the division through the chain of command until reaching the component level. The number of command levels the request must pass through will depend on the size of the component within the joint force. Once the request has reached the component level, it may be submitted to the J-2 for theater collection.

#### **4. The J-2 and the Joint Intelligence Center**

The J-2 must establish a flexible and tailored architecture of procedures, organizations, and equipment focused on the joint commander's needs. This intelligence system of systems complements and reinforces the organic capabilities at each echelon and, when necessary, provides direct support to subordinate commanders whose organic capabilities cannot be brought to bear. [Joint Pub 2-0]

Our example illustrates a situation when the organic capabilities are not sufficient to meet the intelligence need. Therefore, it is the J-2's responsibility to provide direct support to these commanders. AFM 34-2 says that "there is no standard collection management organization at existing joint-level commands" [Ref. 20: p. 5-1]. The J-2 is charged with establishing the intelligence architecture that will support the needs of commanders at all echelons.

Before this architecture can be established, the JFC will normally stand up a Joint Intelligence Center (JIC) from which the J-2 can centrally manage the intelligence effort. It is here that the J-2 and his staff will manage the collection effort and all other parts of the intelligence cycle for the joint force. The J-2 staff will be essential to provide the JFC and the J-2 with an understanding of each component's intelligence capabilities, limitations, and requirements. [Ref. 17: p. IV-9]

The J-2 has specific responsibilities during the collection phase of the intelligence cycle. The J-2 must devise the theater collection plan that will incorporate the use of national systems and systems that are organic to the

theater. The J-2 must also identify, prioritize, and validate those requirements that originate within the components needing support from theater or national collection systems. The J-2 must then task the components for collection. During these activities, the J-2 will maintain a record of accomplishment to evaluate the fulfillment of intelligence needs. [Ref. 17: p. VI-3,4]

Joint Publication 2-0, *Joint Doctrine for Intelligence Support to Operations*, gives precise guidance for the J-2 and his staff concerning their responsibilities within the joint force. It is made clear that the J-2 should be the channel through which requests from the components of a joint force must travel for intelligence support. [Ref. 17: p. V-2] However, Joint Pub 2-0 does not describe what the organizational structure of the JIC *must* look like. The J-2 has the liberty to determine how he wants to manage the intelligence effort within the guidelines provided by the JFC. Consequently, there are no standard procedures on how incoming RFIs from the components will be processed and transformed into routine tasking or dynamic retasking for time-critical requests. For our example, we will look at how RFIs were handled during Desert Storm based on the United States Central Command (USCENTCOM) model.

CRM during Desert Storm began with a review of the intelligence requirements by the Daily Aerial Reconnaissance Syndicate (DARS). This committee was headed by the J-2's collection manager and membership included JFC staff and component representatives. DARS would review intelligence requirements and provide guidance within the JIC on which requirements would be met. The requirements were then passed to the appropriate intelligence discipline such as IMINT or SIGINT. Within these disciplines were Joint Collection Management Cells (JCMC). JCMCs were responsible for prioritization and deconfliction of requirements, and worked tasking for a specific platform, such as the U-2. When the JCMCs were

finished, they passed on their requirements to the Joint Reconnaissance Center (JRC). [Ref. 22]

## **5. The J-3 and The Joint Reconnaissance Center**

The J-2 establishes collection requirements to meet the JFC's operational objectives, while the J-3 determines how to employ assigned RSTA systems available to satisfy the collection requirements. [Joint Pub 3-55]

Within the J-3 is the JRC. According to joint doctrine, the JRC's function is to monitor RSTA assets, establish priorities among them to meet requirements, assign missions to them, deconflict and coordinate RSTA missions with other operations in the area of responsibility (AOR), and assess risk to RSTA assets. The JRC must also inform the J-2 if his collection requirements exceed theater collection capabilities. [Ref. 18]

During Desert Storm, the JRC performed the COM function of the collection management process. This involved the authoritative direction, scheduling, and control of collection operations. This control would be coordinated with the Joint Force Air Component Commander (JFACC) who is responsible for coordinating all air operations in the theater. [Ref. 22]

## **6. Joint Force Air Component Commander**

The J-2 and J-3 will normally work with the components and the JFACC, if assigned, to coordinate national and theater reconnaissance objectives effectively. [Joint Pub 3-55]

Joint doctrine stipulates that the JFC will normally designate a JFACC to "exploit the capabilities of joint air operations through a cohesive joint air operations plan and a responsive and integrated control system" [Ref. 23: p. vi]. The JFACC is responsible for planning, coordinating, allocating, and tasking joint air operations in accordance with the JFC's objectives. The JFACC fulfills these responsibilities through a process called

the joint air tasking cycle. The Air Tasking Order (ATO) is an essential part of the tasking cycle. Throughout the ATO cycle, the JFACC plans, coordinates and tasks air operations in a manner that maximizes their effectiveness and ensures deconfliction. The JFACC resides in the Joint Air Operations Center (JAOC). The JAOC is organized to support the planning of future operations and the execution of current operations. [Ref. 23: p. vii, viii, IV-4-11]

Once a collection requirement has been identified, validated, prioritized, and coordinated among the J-2, J-3 and components, the appropriate collector(s) will be tasked to carry out the mission. This will be done through the Air Tasking Order. When the appropriate tactical-level units receive the ATO, they will execute the mission. [Ref. 18,24] This completes the flow of the RFI from the division level within the Army to mission execution by the operators, as shown in Figure 3-4.

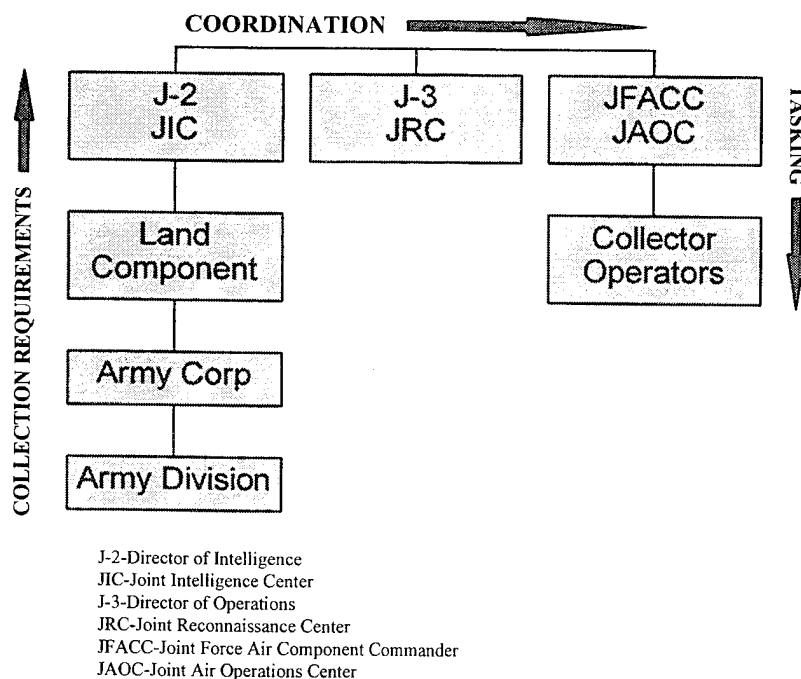


Figure 3-4. Notional tasking flow.



These descriptions of the intelligence cycle and the methodology for theater collection management demonstrate the hierarchical structure of current intelligence processes. When non-organic theater asset capabilities are required, requests for collection initiated at any level must flow up the chain of command to the decision makers and back down again to the collector operators. For tactical commanders, this means that their requests must make a long and time consuming trip from conception to fulfillment. On today's battlefield, events occur so quickly that information must often be collected in NRT to be of any value to the commander. A *sensor-to-shooter* architecture would be more appropriate for meeting the tactical consumer's needs for NRT imagery. A dynamic retasking process that allows for a more direct line of communication between the shooter and the sensor might help to reduce the time required to satisfy the tactical commander's request.

## **7. Dynamic Retasking**

The RFI flow described in Figure 3-4 describes how normal tasking occurs. In some situations, time-critical intelligence needs must be satisfied immediately. During Desert Storm, these types of requirements were met through a process called *quick fires*. Quick fires allowed one particular service component to have control over a specific theater asset for a certain period of time. During the allotted time period, the component exercised control over the asset and was able to redirect it to collect against time-critical requirements. [Ref. 22]

In the author's opinion, quick fires do not represent true dynamic retasking. In essence, quick fire procedures are more like pre-planned dynamic retasking. If a component recognizes a time-critical collection requirement during the quick fire, then he can collect against it. If the component realizes an immediate need and does not have control over the

asset, then the process for normal tasking must be used. The process for normal tasking is not responsive enough to meet NRT requirements.

### C. JOINT COLLECTION MANAGEMENT TOOL

The Joint Collection Management Tool (JCMT) is currently being developed as the migration system for all-source collection management system within DoD. It was selected by the Assistant Secretary of Defense for Command, Control, Communications and Intelligence (ASD(C3I)) to fuse the functionality of several other collection management systems into one system for all of the services. Figure 3-5 shows the JCMT Operational Concept. Ultimately, JCMT will replace and incorporate the functionality of systems

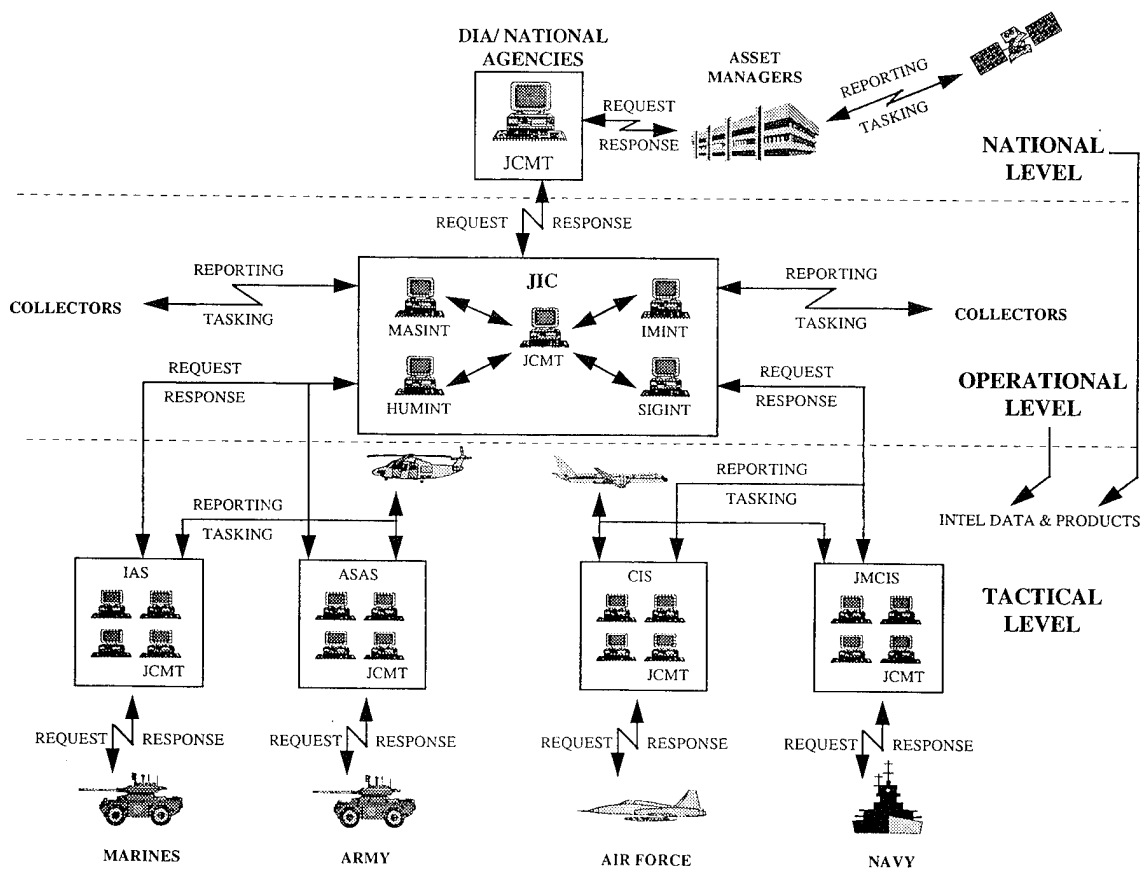


Figure 3-5. JCMT Operational Concept. After Ref. [26].

like the Army's Collection Management Support Tools (CMST), DIA's Collection Requirements Management Application (CRMA), and the Air Force's Collection Requirements Management System (CRMS). TRW is developing JCMT and claims that it will provide state-of-art communications, advanced databases, and a sophisticated user interface. Plans are for JCMT to be embedded into the services' intelligence support systems such as Combat Information System (CIS), All-Source Analysis System (ASAS), Intelligence Analysis System (IAS), and Joint Maritime Command Information System (JMCIS). [Ref. 25, 26]

The baseline for JCMT capabilities includes five major areas of support. These areas are All-Source Requirements, Asset Capabilities and Availability, Message Processing/Communications, Database Access, and Support Tools. Each of these areas will support the following activities: [Ref. 25,26]

- **All-Source Requirements** - functionality includes support for requirements registration, validation, prioritization and consolidation for organic and non-organic requirements. This area will also support correlation of collected data with the requirement(s), establishing collectibles, and monitoring the status of requirements.
- **Asset Capabilities and Availability** - includes models and reference data of all collection assets available to the warfighter. This will include national and theater systems. This area will also support strategy development, evaluation, and tasking and will monitor mission scheduling.
- **Message processing/Communications** - this area will support all the different collection message types for tasking the various collectors. The user will be able to update databases and highlight recent activity. The user will be able to communicate with other

JCMT users. This area will also correlate message types and provide the user with word search capabilities.

- **Database Access** - the user will have access to national collection management databases.
- **Support Tools** - provision of maps, office utilities and security features.

According to the program office, JCMT will be able to provide collection managers at every echelon with the tools they need to task organic and non-organic collectors. Currently, JCMT can provide the user with real time data on the availability of collection assets [Ref. 27]. It is anticipated that this combined with the collector models and reference data will support the warfighter's ability to choose the most appropriate collector to meet his intelligence requirements. Connectivity will also be possible with all other JCMT users. These and other JCMT capabilities may prove to be useful tools in satisfying the time-critical collection requirements inherent to the battlefield.

#### IV. PROHIBITORS OF TIMELY INTELLIGENCE

One of the shortcomings we found is that we just don't have an immediately responsive intelligence capability that will give the theater commander near-real-time information that he personally needs to make a decision. General Norman Schwarzkopf [Ref. 19]

The US intelligence infrastructure has some amazing capabilities, but meeting the needs of every user is not one of them. The military operations during Desert Storm served as a reminder that the intelligence infrastructure needs change. For many years during the cold war, US intelligence systems focused their attention primarily on the Warsaw Pact. Since most of this information was collected during peacetime, the system was afforded time to produce intelligence. Similar time was not available during the military operations of Desert Storm. The rapid development of the crisis in the Gulf region forced the intelligence system to provide support for a largely unexpected contingency [Ref. 28: p. 160-2]. Many shortcomings were identified within the intelligence system, especially with regard to timeliness. This chapter will discuss some of these deficiencies identified during Desert Storm and will focus primarily on those areas that directly and indirectly affect the tasking of collection assets.

##### A. NATIONAL COLLECTION EMPHASIS

According to Major Marshall, the reason why reconnaissance systems have not been able to provide the required tactical intelligence support during conflicts such as Desert Storm is because there has been no coordinated focus on the needs of the tactical consumer. During the Gulf War, the Air Force needed six squadrons of RF-4Cs, but could only employ one and one-half squadrons from the reserves. [Ref. 19: p. 47] Only 5 TR-1s and 6 U-2s were in the theater. The RF-4Cs, U-2s, TR-1s and Tornados could have provided the much-needed imagery of Kuwait prior to the war, but they were not survivable enough to fly over the region until the air campaign

began. Army Brigadier General Scales, director of a Desert Storm special study, concluded that SR-71s could have filled a gap in Kuwaiti coverage prior to the air campaign if they had not been moth balled a year before. [Ref. 28: p. 163,179]

A primary reason for the lack of emphasis on the tactical consumer's needs has been an emphasis on intelligence needs at the strategic level. Most of the reconnaissance systems in use today were not developed to support the tactical warfighter, but rather to support decision makers at higher levels. In the 1950s and 1960s, the strategic mission of the Air Force and the allure of "black" projects strongly influenced reconnaissance development. This led to the development of highly classified systems designed to meet strategic intelligence needs. The famous efforts of Lockheed's "Skunk Works" is an example of that influence. Because reconnaissance systems such as those produced by Lockheed were developed in secrecy, they work well alone, but they do not work well together. Incompatibilities between the various reconnaissance systems greatly reduces the ability to synchronize the collection effort on the battlefield. [Ref. 19: p. 48,50]

Another factor that influenced the intelligence infrastructure was President Dwight D. Eisenhower's strong belief that intelligence systems should be controlled by civilian agencies for fear of misuse by the military. Consequently, the intelligence structure of the United States has been primarily controlled by national agencies since the 1970s. Strategic Air Command operated air reconnaissance assets at the *direction* of national agencies. Additionally, the development and maintenance of a tactical reconnaissance capability organic to the military was neglected in the budgeting process leaving obsolete assets to do the job. [Ref. 19: p. 48]

During peacetime, intelligence typically takes a long time to make its way through analysis done at the national intelligence centers down to operational and tactical levels. Marshall stipulates that the emphasis on

peacetime intelligence operations has helped to create the stovepipe intelligence infrastructure that exists today. This stovepipe infrastructure, shown in Figure 4-1, consists of a small number of unique airborne assets, national production centers, theater-level fusion centers, a few organic tactical assets, and other national technical systems. Marshall states that these disparate systems have been more responsive to Washington than to the warfighter. [Ref. 19: p. 48]

This well-rehearsed response to Washington is understandable as peacetime operations do not normally involve the tactical warfighter. Since peacetime operations are the norm, and crisis operations the exception, the

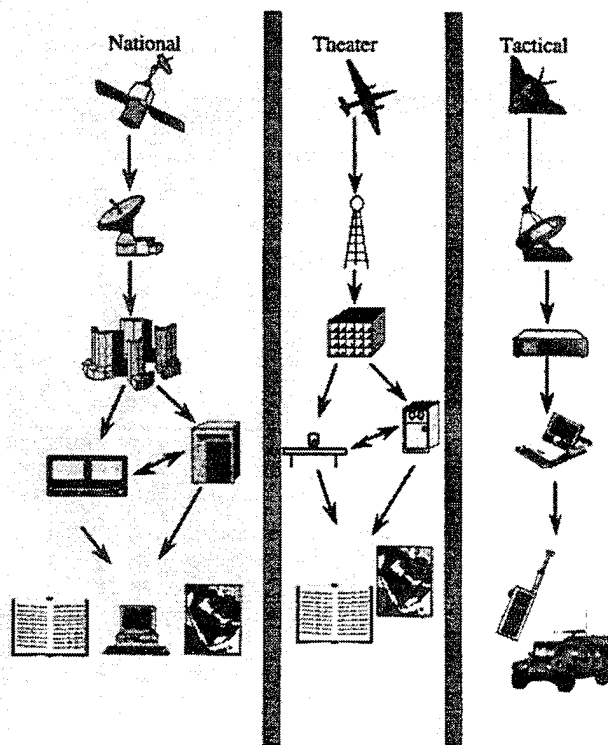


Figure 4-1. Current Stovepipe Architecture. From Ref. [29].

intelligence system does not usually get much *practice* during crisis situations when NRT tactical support is required. Therefore, the system does

not handle requests for NRT intelligence from tactical levels very efficiently when crises occur.

Figure 4-1 shows that national, theater, and tactical collection systems do exist, but that they do not communicate well with one other. The barriers in the figure illustrate the inability of these systems to carry out mutually supportive operations. This lack of communication and interoperability between collection systems inhibits the tactical user's ability to access national and theater collection resources. The figure implies that there are equal capabilities at all three levels, but this is untrue. As discussed earlier, a greater capability exists at the national level with decreasing capabilities at the theater and tactical levels respectively.

Even though a limited tactical collection capability exists, most intelligence collection systems were primarily developed to support strategic decision making and not the tactical warfighter. Today, it appears that the focus may be shifting somewhat to support the tactical consumer. Intelligence problems in the Gulf War, the shifting of the cold-war posture to the post-cold-war posture, and other factors have brought attention to the need for a more tactical focus. *C4I for the Warrior* philosophy is making the warfighter "king." Consequently new systems and technologies are being developed to support the tactical reconnaissance and surveillance needs of the warfighter. Adding new systems and technologies alone will not solve the intelligence problems witnessed in Desert Storm. Integrating these new tactically focused assets with new capabilities into a strategically developed infrastructure will require more changes. Concepts of operations and other doctrine must be developed to support this transition to a more balanced strategic and tactical emphasis.

As evidence of this growing tactical emphasis, in November of 1993, the Congressional Authorization Conference published a report that stated, "tactical reconnaissance is relatively more important to national security



than at any other time in our history" [Ref 10]. As a result of this report, the DARO was created to manage the development and acquisition of new tactical airborne reconnaissance systems. DARO is currently overseeing the development and demonstration of technologies that will support the tactical intelligence requirements inherent to the battlefield. Some of the programs being pursued are the short, medium, and long range UAVs. The HAE UAV is being developed to support theater intelligence requirements through long dwell, high altitude surveillance and reconnaissance. [Ref. 10]

## **B. J-2 STAFF COLLECTION EXPERIENCE**

One problem within the theater J-2 staff at the JIC during Desert Storm was the lack of collection management experience. Due to manpower limitations and other personnel factors, the theater J-2 was not always able to bring in military personnel with previous experience in collection management. Consequently, the learning curve among some J-2 personnel was steep. Evidence of this was a tremendous increase in the number of daily collection activities throughout the war. Part of the problem was that the collection management specialty was not seen as promising for promotion as were other intelligence specialties. Consequently, there was not an abundance of officers with collection management experience available. [Ref. 22]

## **C. LIMITED COLLECTION ASSETS**

According to Major Marshall, the limited number of collectors available on the battlefield significantly impacts the tactical commander. He states that there are approximately 12 RC-135s and less than 50 TR-1s in the Air Force inventory. He concludes that this is because the Air Force has focused on acquiring a limited number of large and expensive collectors at the expense of the tactical consumer. Help is on the way with JSTARS initial operational capability coming on board in the mid 1990s. [Ref. 19: p. 59]

Also, DARO's UAV development effort may provide some relief when and if the UAVs are ever operational. Even with the hope of new platforms arriving on the battlefield, the challenge remains to meet unlimited requirements with a limited amount of resources.

#### **D. SUPPORTING TOOLS FOR COLLECTION MANAGEMENT**

During Desert Storm, many of the collection management activities that occurred within the J-2 at the theater JIC were done manually. There were no software support tools to aid in the prioritization or tasking of collectors. Certain tasking messages had to be written out manually. This turned out to be a long and laborious process. Automation tools were needed to support the timely processing of collection management activities. [Ref. 22] Automation tools could have been used to make the tasking process more efficient through better communication (through automated and standardized tasking messages and formats), faster tasking message development, and administrative support functions.

#### **E. AIR TASKING ORDER GENERATION**

The JFC or CINC for a theater will usually designate a JFACC during joint operations to coordinate and control joint air operations. The JFACC will coordinate the air activities within the theater through the ATO. The ATO process is currently a 72 hour cycle that includes the steps of JFC and service component coordination, target development, weaponeering and allocation, joint ATO development, force execution, and combat assessment. [Ref. 23] Because of the long time required for planning and coordinating all air operations through the ATO, there is concern about its timeliness to meet immediate collection needs.

Currently, there is a struggle between the Air Force and Army over the control of theater UAVs. General Joseph Ralston, former commander of ACC, has called for all UAV operations to fall under the ATO. The Army,

however, is concerned that the ATO, though good for long term-guidance, is not flexible and responsive enough to accommodate the immediate collection requirements that Army commanders face in combat. The Army is also concerned about not having control of UAV assets during operations. [Ref. 30: p. 23] A collector tasking method is necessary that provides Army commanders with a responsive collection capability during crises, but also allows the JFACC to synchronize all air operations so as to maximize their overall utility.

## **F. TASKING PROCEDURES**

Chapter III describes in detail the procedure through which intelligence requests are submitted up the chain of command and sent back down to the operators for collection. According to Major Marshall, the number of "wickets" in the intelligence cycle is one of the largest inhibitors to tactical commanders getting the timely intelligence support they need on the battlefield [Ref. 19: p. 63]. It may be possible to solve the problem through "modification of the command and control process and streamlining...reporting procedures" without expensive system modification and hardware solutions [Ref. 31]. The goal of this thesis is to describe such a streamlined process for tasking collection assets in a timely fashion.



## V. SCENARIO ASSUMPTIONS

### A. BACKGROUND

Sometimes the best way to visualize how something is going to work is to illustrate it by using an example. In order to understand how dynamic retasking could work for the HAE UAV, an example will be used to describe how the tasking could flow given a hypothetical example. This example scenario will help to facilitate the realism of a possible NRT imagery requirement that an army commander may experience on the battlefield. By following through the tasking process for the following scenario, the reader will be able to assess how real is the need for NRT imagery on the battlefield and how the HAE UAV might meet those needs through a specific dynamic retasking procedure.

Given that dynamic retasking is assumed to be an exception to the rule and not the normal operating procedure, the reader must understand that it would be very difficult, if not impossible to describe the *typical* scenario in which the commander on the battlefield finds himself in need of NRT imagery. This chapter will attempt to describe a *probable* scenario in which an army commander requires NRT imagery.

### B. THEATER ASSUMPTIONS

We will assume that the conflict for this scenario is similar to the conflict that occurred during Desert Storm. This implies that there is a single theater of operations. This means that the HAE UAVs that have been attached to support this conflict are only responsible for activity within the theater. Consequently, it is assumed that no HAE UAV tasking from outside the theater CINC's area of responsibility will be accepted, unless it supports the CINC's objectives. We will also assume that the theater CINC is in control of the operations and he also acts as the JTF commander. For purposes of this example, assume that the theater CINC has designated a JFACC and that other important joint staff members, such as the

J-2 and J-3, are in place in the theater and are acting in accordance with joint doctrine stipulated in the Joint Pubs 2.0 *Joint Doctrine for Intelligence Support to Operations*, 3-55 *Reconnaissance and Surveillance and Target Acquisition Support*, and 3-56.1 *Command and Control for Joint Air Operations*.

In accordance with the HAE UAV CONOPS, all HAE UAV assets will be operated by ACC under the direction of the theater CINC [Ref. 12]. This CINC will accomplish this by issuing guidance to the JFACC and the joint staff concerning the CINC's EEIs and air apportionment decisions. The specifics of the CINC's guidance is described more thoroughly in Joint Pubs 2.0 and 3-56.1

### **1. Collection Management Responsibilities**

The J-2 will act as the collection manager for the theater and he will observe all of the responsibilities assigned to him in accordance with the joint publications. Chapter III above gives the details concerning his responsibilities as well as the responsibilities of the JFC and other joint staff members. See Joint Pub 2.0 for more details.

We will assume that the tasking process described in Chapter III will be in effect, and that for dynamic retasking, a slightly altered procedure will be required. This procedure will be discussed in detail in the Chapter VI.

### **2. Basing Considerations**

According to the CONOPS, the HAE UAV detachment will have the capability of being forward based or based behind the theater of operations [Ref. 12]. Because of the HAE UAV's long range capabilities, it will be able to operate from this distance allowing valuable and possibly scarce ramp space to be used for vital attack aircraft, such as fighters. If space is available, it is conceivable that the HAE UAV detachment could be based within the theater of operations. The optimum basing alternative may vary depending on factors such as the available ramp space and support available. For this scenario, the assumption will be made that the HAE UAV detachment is based behind the immediate theater of

operations. We will arbitrarily assume a distance of at least 1000 NM from the theater.

### **3. Communications and Supporting Tools**

Communications links are assumed to be established and in place. This implies that the theater J-2 will be using the Joint Deployable Intelligence Support System (JDISS) to support intelligence-related planning and operations. We will also assume that JDISS is available to the various service components and that corp and division intelligence personnel have access to JDISS as well. JCMT will also be available on JDISS so that the division level of command will be able to utilize the JCMT current and planned capabilities described in Chapter III above. We will assume that connectivity exists between all JCMT users. For our example, JCMT users will include the division, corp, land component, J-2, J-3, JFACC, and HAE UAV operators. We will also assume that voice connectivity is available among these entities through the standard command, control, and communication hierarchy.

### **C. TASKING SCENARIO**

For our example, a need for NRT imagery will be realized at the division level of command within the United States Army. An advancing Army division is moving forward when its forward element "unexpectedly" begins to take indirect fire from over a range of hills. The division needs "eyes" on the other side of the hill immediately for targeting purposes and situational awareness. The risk to the mission and human life is high, so the priority for imagery support is also high.

The division is not able to see over the hill for a number of reasons. Bad weather disqualifies the use of certain collectors, and organic collectors are not available with sufficient range. Consequently, the division commander's options are limited. He is forced to consider requesting support from non-organic collectors as his only means of collection.

The commander decides that for this situation he needs a “big picture” view of the battlefield. He wants to be able to see his own forces as well as the enemy forces that are engaging him. He would also like to have imagery intelligence immediately to support his own counterattack, to minimize casualties among his troops and to reduce other losses to his force. The commander inquires of his intelligence officers and other staff for support and so the collection management process begins.



## VI. PROCESS FOR DYNAMIC RETASKING

### A. INTRODUCTION

The process for dynamic retasking involves many entities. In order to maximize the effectiveness of the dynamic retasking process, active participation by the JFC and J-2 staff will be necessary. Their involvement and support of dynamic collection requirements is essential to support the timely fulfillment of such requirements. In addition, a standard procedure must be in place that will facilitate the timely processing of real-time collection requirements. A procedure must be in place that will ultimately connect the requester of collection support to the actual collector operator. This chapter will describe the anticipated responsibilities of the JFC and J-2 as well as provide the structure and definition for a procedure that may facilitate the timely fulfillment of real-time requirements given the assumptions made in Chapter V.

### B. JOINT FORCE COMMANDER'S ROLE

The responsibility for the effective dynamic retasking of the HAE UAV begins with the theater CINC or his designated Joint Force Commander. According to Joint Pub 2.0, the JFC's guidance and directives will determine the way in which the intelligence system operates during the type of conflict described in Chapter V.

Intelligence requirements are identified based on the JFC's guidance and direction, estimate of the situation and objectives. The commander's requirements must be the principal driver of intelligence system components, organization, services, and products. [Joint Pub 2.0]

Since the JFC carries the responsibility of being the *principal driver* of the intelligence system, he has the authority to provide guidance which may determine the success or failure of dynamic intelligence collection operations. For optimum performance of the intelligence system to meet time-critical collection requirements, the JFC may choose to provide guidance and procedures on how he wants the J-2 to handle time-sensitive requirements. These directives need not be specific, but may

only require that the JFC ensure that the J-2 and other pertinent staff know that he gives the dynamic retasking collection missions a particular priority with regards to other collection missions. The JFC may also choose to specify priorities within the different types of time-critical intelligence collection missions that may occur such as deep reconnaissance and surveillance versus short or medium range activities. The JFC may prioritize geographical areas or regions that he considers more important to support if competing intelligence or collection requirements are in conflict for scarce resources. This may become important if certain areas of the theater gain more strategic significance than other areas during a particular time period.

Another step the JFC may take to improve dynamic retasking capabilities is to provide apportionment guidance to the J-2, J-3, and JFACC as well as other staff involved in Collection Requirements Management (CRM) and Collection Operations Management (COM) activities. This apportionment guidance could provide such information as a percentage of collection assets, such as the HAE UAV, to be dedicated to dynamic retasking. The JFC may designate a certain percentage of the HAE UAV attachment to be available for use when and if a time-critical requirement is identified. It may be possible to employ all the HAE UAVs but to earmark certain assets for redirection from their current missions in order to fulfill time-critical collection requirements.

### **C. J-2 STAFF CONTINGENCY**

Given that the J-2 receives support from the JFC as described previously, the J-2 will be better prepared to meet the dynamic collection requirements common to the battlefield. However, the responsibility still rests with the J-2 on how he will specifically employ the intelligence system to meet the JFC's objectives.

Ultimately, satisfying these requirements [those identified by the JFC] will depend on the ability of each J-2 and their intelligence staffs at all levels of command to (1) employ joint force organic intelligence resources; (2) identify and, when assigned, integrate additional intelligence resources such as the

joint intelligence center (JIC); and (3) apply national intelligence capabilities. [Joint Pub 2.0]

For the J-2 to be able to fulfill these responsibilities most effectively, it seems appropriate that practice is in order. To ensure that the J-2 and his staff are capable of performing these tasks, exercises should be conducted to include J-2 and staff participation. It is also advisable to have intelligence personnel trained and ready for crisis situations so as to avoid the deficiencies in collection management expertise experienced during Desert Storm.

Desert Storm demonstrated that the speed of modern warfare dictates that commanders receive timely and accurate information to support them in the decision making process. Along with being timely and accurate, RSTA forces must be survivable, reliable, suitable, and interoperable (connectivity). To achieve these capabilities, they must be exercised during peacetime with the goal of being able to operate within the commander's operational planning cycle. [Joint Pub 3-55]

Joint Pub 3-55 emphasizes the need to rehearse during peacetime to ensure that our full intelligence capability can be brought to bear during conflict. It will also be important to have trained and experienced intelligence personnel available to handle time sensitive requirements that exceed the normal tempo of modern warfare. Personnel must be trained and experienced with procedures as well as be able to effectively use the supporting tools available to them such as JCMT.

In order for the maximum amount of dynamic requirements to be met during conflict, not only are personnel to be trained and experienced for normal wartime operational tempo, but procedures for dynamic collection need to be established and practiced as well. Joint Pub 3-55 states, "The collection architecture must be in place and the procedures exercised during peacetime in order to implement a collection plan effectively at the beginning of hostilities." Joint Pub 2.0 reiterates this need for a collection architecture that is able to handle dynamic requirements when it states, "Where there are immediate threats...the intelligence system may

need structure and methodology to provide near-real-time information and/or intelligence.”

To summarize, the state of readiness of the personnel involved with real-time collection management activities is extremely important. The procedures themselves can not guarantee success. Trained and experienced personnel combined with a streamlined real-time collection process will provide the best framework for the successful fulfillment of dynamic collection requirements on the battlefield.

#### **D. TASKING PROCESS AND FLOW OF REQUIREMENTS**

##### **1. Initiating the Request For Information**

The tasking process for collection begins with the requester. In our case, the requester is the commander of an Army division confronted by an “unseen” enemy on the battlefield. The first step that must take place involves the commander and his staff. In accordance with the Army procedures outlined in AFM 34-2 *Collection Management and Synchronizations Planning*, the division must go through the steps of developing requirements, developing the collection plan, and tasking or requesting collection. The time that it takes to complete these steps depends largely on the experience of the commander and his staff and the circumstances surrounding the requirement [Ref. 20]. However, if the division is equipped with the appropriate support tools, then the time will likely be reduced.

The Joint Collection Management Tool (JCMT) is anticipated to offer this kind of support. Planned JCMT capabilities include models of all RSTA platforms. This should eventually include the HAE UAV, and for our example we will assume that it does. This capability will allow the requester to examine the performance characteristics and capabilities of various collectors and allow him to request support from what he believes to be the most appropriate collector. JCMT will also provide availability information to the requester which may influence his decision to request support from a particular resource. In order to achieve the maximum

response in a time critical situation, the intelligence staff should already be experienced in using JCMT and other available intelligence support tools provided by JDISS, and be aware of collection asset capabilities and availability. This will reduce unnecessary research and decrease the time required to complete the first three steps of collection management identified by AFM 34-2.

For our example, we will assume that the commander and staff have completed their assessment of the situation and decide to request support from the HAE UAV. Normally, the commander would submit his request to the next highest level of command. This process is described in detail in Chapter III. Because of the time factor of this scenario, the commander needs support immediately, and the normal tasking process is not fast enough to meet his requirement. An altered tasking mechanism is necessary for the commander to get what he needs.

Senior commanders should authorize skip-echelon direct intelligence support when necessary to provide timely critical intelligence for operating forces being constituted, in transit, or engaged...Command authorization of skip-echelon intelligence support does not alleviate the requirement to provide the same intelligence to intermediate commands through the chain of command and to supporting commands and organizations. [Joint Pub 2.0]

Joint Pub 2.0 highlights this need for skip-echelon procedures when disseminating intelligence products to units in need of time critical intelligence. It is the author's opinion that similar skip-echelon procedures are necessary for commanders when requesting collection support to meet time critical intelligence requirements. It is essential, as with skip-echelon dissemination, that the chain-of-command be kept informed of all skip-echelon requests for collection support. Consequently, higher levels of command may review and question those skip-echelon requests that seem inappropriate or unnecessary. Higher levels of command may also deem it necessary to halt skip-echelon requests that may interfere with other higher priority collection efforts. In other words, all skip-echelon requests will be accepted unless higher level commands actively reject a request. Figure 6-1 shows a possible skip-echelon collection request procedure.

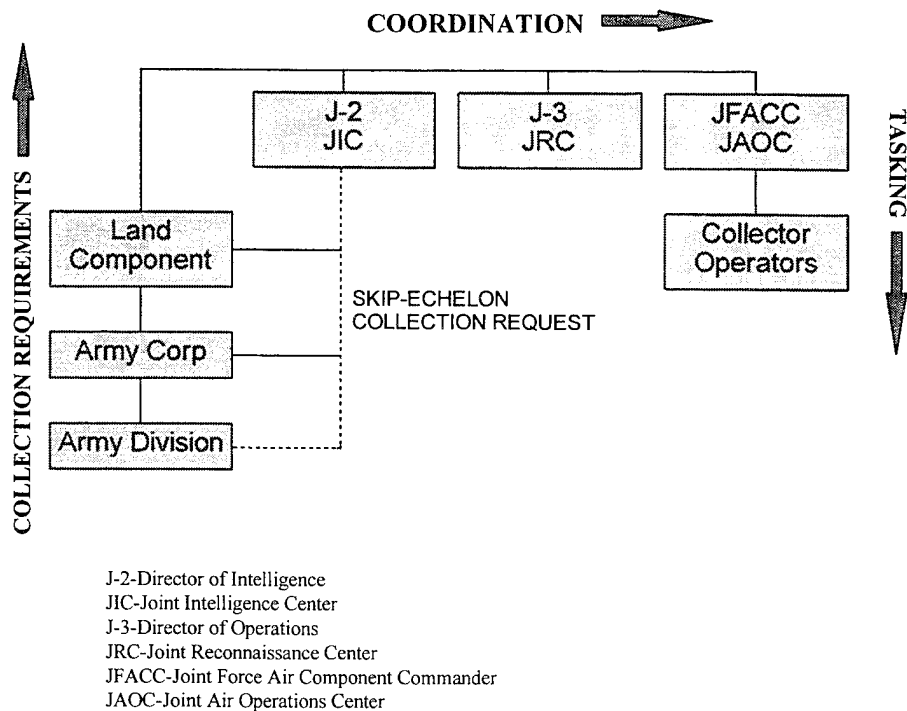


Figure 6-1. Skip-echelon collection request procedure.

Given that skip-echelon procedures are in place, the division commander may submit his request directly to a specified theater collection management authority for time critical requirements. Figure 6-1 shows this authority as the J-2. This communication will be possible via JCMT. Plans are for JCMT to provide connectivity between all JCMT users. This communication will include a *chatter* capability which allows JCMT users to write back and forth to one another in real time. Voice communications will also be in place between all JCMT users. JCMT will support all required tasking message formats so that the division commander will be able to submit his collection request in a format that will be acceptable and understandable to those JCMT users located within the specified collection management authority for the theater. Tools such as JCMT should reduce the time required to receive and process tasking and request messages, and eliminate the manually written procedures required during Desert Storm. For the purposes of

this thesis, the aforementioned collection authority for time critical collection requests will be called the Dynamic Requirements Collection Management Authority (DRCMA).

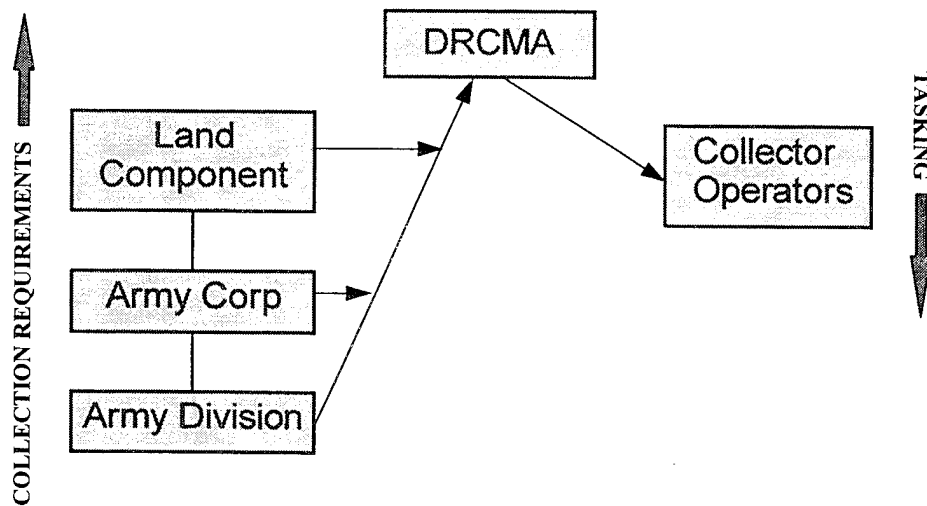
Since JCMT will support normal collection procedures and dynamic collection requests, a distinction must be made between the two. Both normal and immediate collection requests must be organized by the commander and submitted through the appropriate channels. For dynamic collection requests, the requester will be able to flag his request within JCMT so that it is routed directly to the DRCMA. Normal and dynamic collection procedures will operate concurrently during conflict, therefore it is the commander's responsibility to utilize skip-echelon procedures only when necessary.

## **2. Dynamic Requirements Collection Management Authority**

The normal tasking procedures for collection management stipulate that requests will make their way up the chain of command and be passed from the components (for our example the land component) to the J-2. The J-2 will ordinarily receive all requests and perform the functions of CRM. Upon completion of CRM, the J-2 will pass the collection requirements to the JRC of the J-3. The JRC will carry out COM. Finally, the tasking is coordinated and directed by the JFACC and executed by the operators. Even with skip-echelon procedures in place, the request must still travel through the three separate entities of the J-2, JRC and JFACC before reaching the operators. Consequently, this process may not be timely enough to satisfy NRT requirements. The process above needs revision if the dynamic retasking of collectors such as the HAE UAV is to be effective. This process is appropriate for planning, but a more responsive process is required to meet the time critical requirements that commanders may face on the battlefield.

In the author's opinion, one solution may be to create a single entity that can perform all of the functions described in the process above. The DRCMA is the

proposed name of the cell that could perform the functions of CRM, COM, and coordination and direction. Figure 6-2 shows the simplified process of tasking.



DRCMA - Dynamic Requirements Collection Management Authority

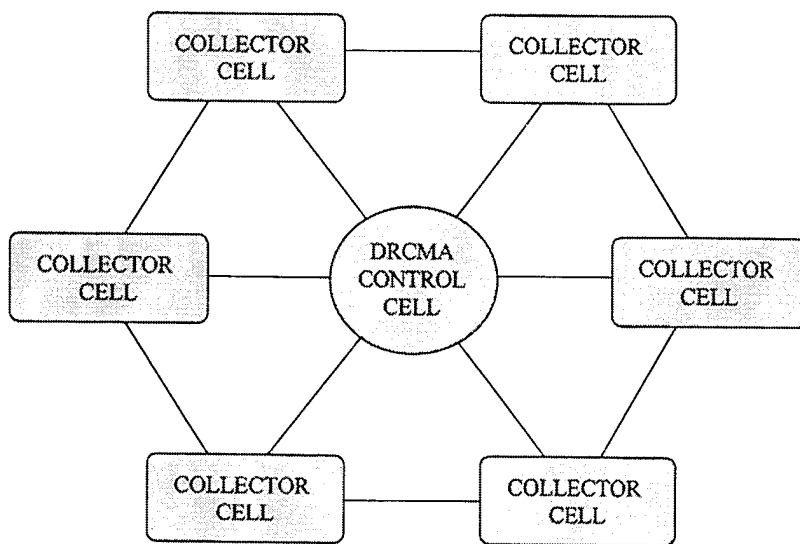
Figure 6-2. Dynamic Requirements Collection Management Authority tasking procedure.

For our scenario, the division commander determines that the HAE UAV is the most appropriate collector to meet his requirement. He will submit the request via JCMT. Voice or *chatter* communications may be utilized if necessary. JCMT is planned to provide the necessary tasking message format and links between JCMT users so that the message can be sent and received in real-time. At this point, the tasking message will go directly to the DRCMA, however, higher levels of command, such as the corp and component levels, will have the authority to review all requests and reject requests deemed unnecessary. It is important to emphasize that these higher levels of command give their consent to the request by offering no response. This allows the tasking message to be sent in the least amount of time.

Once tasking messages are received by the DRCMA, they will automatically be directed to the appropriate collector cell. Collector cells will perform CRM and



COM activities for only one specific collector, such as the HAE UAV. The collector cell will validate the time critical requirement and make decisions in line with the JFC or theater CINC's objectives and guidance. The cell may reject the request if it does not support the JFC's objectives. The cell may also reject the request if other dynamic requests have a higher priority or may pass the request to a currently unused resource. If the request is not appropriate for that collector, then the collector cell may pass it to the most appropriate cell within the DRCMA. The requester will be notified via JCMT if his request has been denied. It is critical that requesters be notified of denied requests as soon as possible so that their request may be submitted through the normal collection process. Figure 6-3 shows the physical structure of the DRCMA.



DRCMA - Dynamic Requirements Collection Management Authority

Figure 6-3. Dynamic Requirements Collection Management Authority structure.

Once CRM and COM have been performed for valid requests, then coordination and direction will be done by the DRCMA control cell. The DRCMA control cell will have the authority to task collectors, but will maintain an intimate

relationship with the JFACC and the JAOC to ensure deconfliction and the proper coordination necessary to achieve optimum air operations effectiveness.

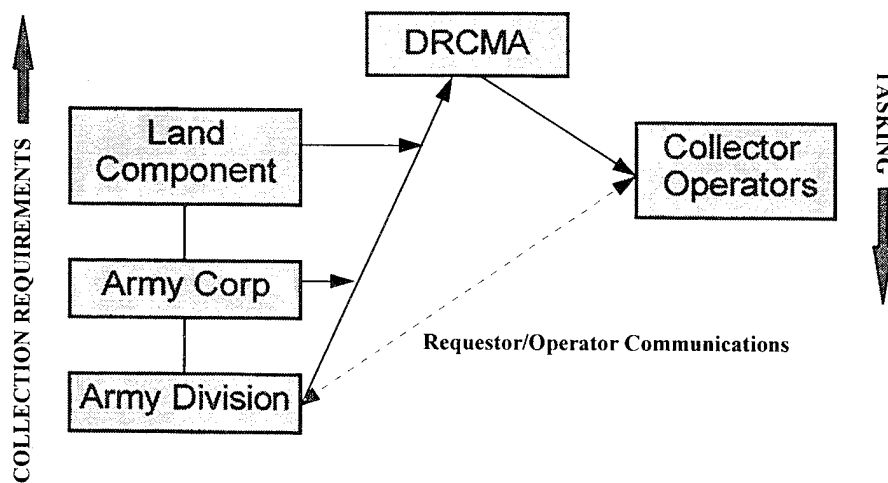
Each collector cell will consist of personnel representing the J-2, JRC or J-3, and the JFACC. J-2, J-3, and JFACC teams will perform their normal functions, but as a unit with a higher degree of integration. The team will operate under guidance given by JFC or theater CINC. J-2 personnel within the team will oversee decisions regarding the acceptance of requests based on the JFC EEI's guidance and priorities. His decision will also rest upon special guidance given by JFC concerning dynamic collection requirements. The J-3 team component will be aware of asset availability and will ensure with the J-2 element that his collector is the most appropriate. The JFACC component will be aware of all air activity and ensure the proper coordination and deconfliction takes place, then direction given to operators through the control cell. Collector cells will be able to task collector operators, but must ensure they have authority and permission from the control cell.

In the author's opinion, the DRCMA should be located close to the JAOC. The close proximity of the DRCMA and JAOC will promote the intimate relationship necessary to ensure deconfliction. This will also allow collection operations to be performed in concert with all other air operations, including planned collection operations and air combat operations to maximize overall air operations effectiveness.

### **3. HAE UAV Operational Unit**

Once the DRCMA has validated a dynamic requirement, then it may be sent to the collector operators. The tasking may be sent by the collector cell to the actual operators via JCMT. The collector cell will also have the capability to connect the Army commander with the actual collector operators. Since operators will receive tasking through JCMT, they will have connectivity with all other JCMT users including the Army division commander in our example. Figure 6.4 shows this requester/operator connection.

This type of requester/operator communication may be useful if the HAE UAV is sending imagery directly to the Army division. This will allow the Army commander to provide the collector operators feedback to insure fulfillment of the requirement. This communication link may also prove valuable if the original requirement leads to other dynamic requirements. In this case, the requester may be able to pass requirements directly to the operators, ensuring the most timely tasking procedure possible. JCMT will have the capability to connect all JCMT users and real-time communications could be accomplished in the *chatter* mode. Voice communications could also be used as an alternative or to supplement JCMT communication capabilities.



DRCMA - Dynamic Requirements Collection Management Authority

Figure 6-4. Requester/Operator communications capability.

The tasking process described above provides a framework through which tactical commanders may request immediate collection support. By incorporating skip-echelon procedures and combining the functions of several entities into the DRCMA, a process has been defined that may satisfy the dynamic collection

requirements that field commanders may face on the battlefield. Table 6-1 compares the normal collection process with the dynamic collection process. The elimination of steps in the normal collection process is expected to shorten and simplify the normal tasking process giving it the potential to satisfy the time-critical collection requirements that will likely be experienced during combat.

Table 6-1. Normal and Dynamic Tasking Processes.

NORMAL TASKING PROCESS	DYNAMIC RETASKING PROCESS
1) Division develops requirements	1) Division develops requirements
2) Division develops collection plan	2) Division develops collection plan
3) Division tasks organic assets or requests collection	3) Division submits skip-echelon request directly to DRCMA
4) Request approved and forwarded by the corp level of command	4) DRCMA performs COM, CRM, coordination, deconfliction and tasking functions  - J-2 element performs CRM  - J-3 element performs COM  - JFACC element coordinates, deconflicts, and tasks collectors
5) Request approved and forwarded by the component level of command	5) Collector operators perform mission
6) J-2/JIC reviews, validates and prioritizes collection requests	
7) J-3/JRC matches requirements with collection assets	
8) JFACC coordinates all air operations to ensure deconfliction	
9) Tasking for collector operators provided through the ATO	
10) Collector operators perform mission	

Table 6-1 shows that the normal tasking process involves ten distinct steps, whereas the dynamic retasking process takes only five. If we assume that each step

takes approximately the same amount of time, then we could safely say that the dynamic process takes half as much time. From this vantage point then, it is clear that the simplified process will require less time. However, it is probably an unrealistic assumption that each step is equivalent in time since each step is unique and involves dissimilar entities and procedures. It is difficult to predict the exact time involved in each step as the inconsistent and unpredictable nature of war makes it impossible to do so. The fog and friction of war introduce a great deal of variability in the expected time values of each step. Major Marshall shows from his research that conventional reconnaissance system timelines reflect this variation. The data he cites reflects that the total time necessary to get intelligence to decision makers is between 51 and 420 minutes. This time includes the activities of intelligence processing, production, exploitation and dissemination, therefore, it does not represent time values we would expect to see in the tasking portion alone. [Ref. 19: p. 61]

Because of the difficulties associated with predicting the time involved in each step, and the variability introduced by the fog and friction of war, it would be most appropriate to test each of the normal and dynamic tasking processes to determine a true picture of the time involved. Several tests could be performed for this purpose. The most basic method might be to create and run a computer simulation that would compare the two tasking processes. Another option may be to practice both tasking processes during military exercises using real intelligence personnel and equipment. Another option may be to create a test unit that could perform the functions of the dynamic retasking process in a simulated environment and compare the results with the normal process being used in ongoing US military operations and contingencies.

## E. RECOMMENDATIONS

### 1. Possible Problems

The process described above may work well under some conditions, but it will undoubtedly encounter problems given demanding circumstances. It must be remembered that this process was developed based on the premise that dynamic retasking for collection would be the exception to the rule and not the norm. Under these kinds of circumstances where the number of real-time requirements generated is a small percentage of all collection requirements, the process will likely be effective. However, if the number of real-time requirements grows to an excessive amount, then the effectiveness of the DRCMA may decrease significantly as requirements exceed collection resources.

It is possible that as commanders use the DRCMA process for rapid collection and find that it satisfies their needs, they will likely use it to meet more and more of their requirements. This tendency will require that higher echelon commanders monitor requests more diligently to insure that tasking requirements are valid for the DRCMA process. If dynamic collection requests become too numerous, then the DRCMA process will become bogged down, and consequently satisfy fewer and fewer time-critical requirements.

As the number of collection requests grows, it is also possible that the DRCMA mechanism will become a bottleneck in the process. One way to combat *bottlenecking* may be to increase the number of collector cells and delineate tasking authority directly to the cells. The cells could be divided in at least two, and possibly more, ways to reduce bottlenecking in the process, as shown in Figure 6-5. The first option could be to divide cells into geographic operating areas and group all of the distinct collector cells for a particular region together. These geographic regions could be determined by the JFC. Another possibility may be to divide the cells by mission. This would allow all the collector cells to be grouped by the different types of collection missions. In both of these examples, the tasking

authority could be delineated further to each collector cell within the geographic or mission divisions. This would allow the collector cells to respond quickly to dynamic requirements with minimal procedural steps within the DRCMA chain-of-command. It must be noted, however, that such a delineation of tasking authority will likely make coordination a more complex problem and may reduce overall effectiveness of the entire collection effort of the air campaign. The tradeoff between timeliness and effectiveness/efficiency must be realized and decisions made as to which is more important. This problem will not go away easily as long as there are unlimited requirements stacked against scarce collection resources. It may be wise to vary the delineation of tasking authority within the DRCMA during operations to meet changing JFC priorities concerning timeliness versus effectiveness and efficiency.

As an example, the JFC may decide that timeliness is more important during a particularly fast-paced phase of the conflict. In that case, tasking authority may be delegated to the collector cells in the DRCMA to reduce the time required to fulfill a requirement. If the situation in the theater changes, then the JFC may choose to emphasize the overall effectiveness of the air campaign, and tasking authority may then be moved back up the chain-of-command to the DRCMA control cell. This action may decrease timeliness, but increase the level of coordination required between the JAOC and the DRCMA. If the pace of combat slows, this option may be more appropriate for the DRCMA activities.

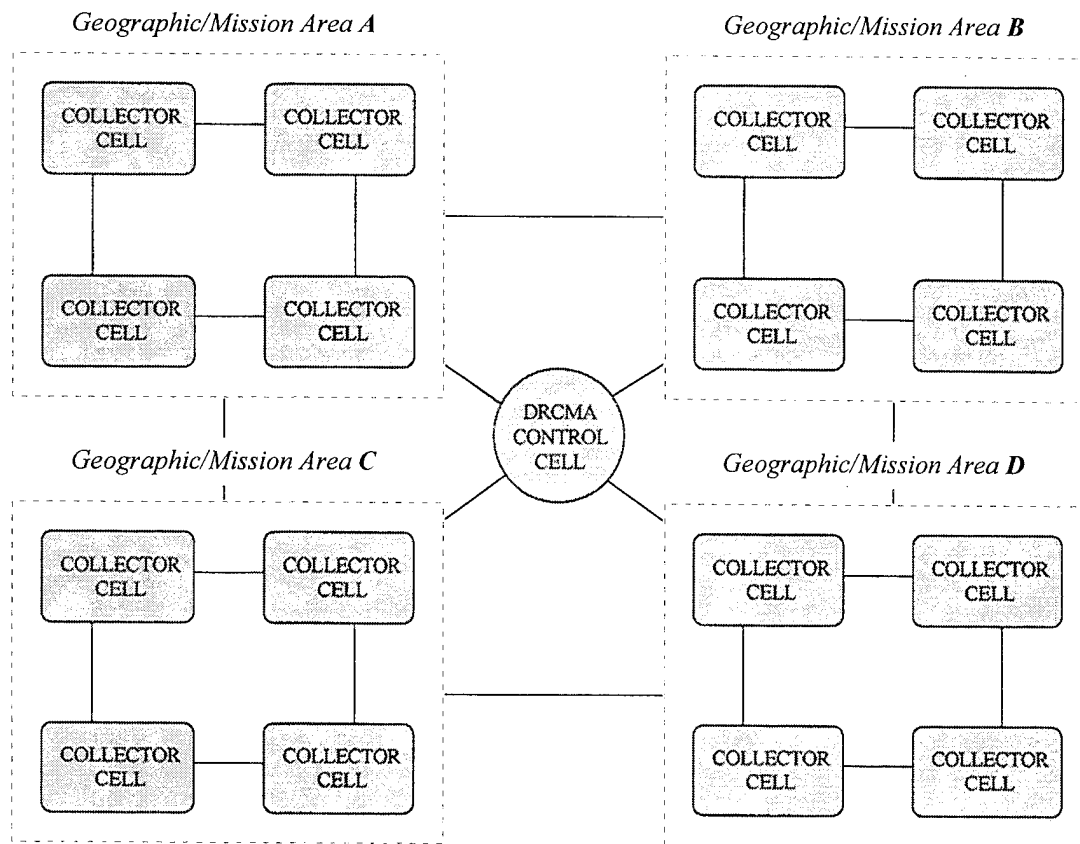


Figure 6-5. Geographic and Mission divisions within the DRCMA.

## 2. Requester Competency

The timeliness of the DRCMA process depends largely on the ability of the requester to choose the most appropriate collection platform to meet his requirement. If the collection request is not made for the best collector, then it will require more time for the request to be routed to the most correct platform. This represents a shift in methodology for intelligence personnel who are accustomed to making decisions regarding the most appropriate collector for a mission. In the DRCMA process, the collector cell team will ultimately make these decisions, but if a change is necessary, then the time to satisfy a requirement will increase. Consequently, it is imperative that intelligence personnel on the requesting side be competent to choose the best collector for the particular collection request. JCMT



will support the requester in making the best decision by providing a model of all collectors available. JCMT will also provide information concerning the specific capabilities and availability of each collector.

## F. SUMMARY

The collection management process involves many entities and many steps are required to fulfill a requirement. It will be difficult to satisfy dynamic requirements given the normal collection process. Incorporating a process that will meet the dynamic collection needs inherent to the modern battlefield begins with JFC involvement and interest. He must provide the guidance and authority necessary to support the process. The J-2 and his staff must be trained and experienced with dynamic collection procedures before hostilities begin. The current process for collection could be altered in several ways to ensure timely and effective tasking of collection assets. Instituting skip-echelon procedures will reduce the time normally required for requests to travel through the chain-of-command. Combining the functions of the J-2, JRC, and the JFACC into a single entity, called the DRCMA, will facilitate a more timely response to dynamic collection requests. The DRCMA will also provide flexibility during combat by delineating tasking authority to meet the JFC priorities with regard to timeliness and overall effectiveness. This delineation of authority could be exercised through geographical or mission area divisions within the DRCMA to increase timeliness and reduce the possibility of bottlenecks. The timeliness of the DRCMA process also depends on the ability of requesters to select the most appropriate collector. JCMT will support the requester's ability to make a wise selection by providing a model of all the collection assets and information concerning their respective capabilities and availability.



## VII. FURTHER CONSIDERATIONS

### A. BACKGROUND

This thesis has attempted to describe the current intelligence system and the methods through which that system processes real-time intelligence requirements. The prohibitors to providing timely intelligence products through that intelligence system to commanders on the battlefield have been discussed. The capabilities of the HAE UAV have also been highlighted, and an attempt has been made to describe a new process of satisfying real-time collection requirements that can better exploit the new capabilities offered by the HAE UAV and reduce or eliminate those factors which have prohibited timely collection in the past. This new process, which utilizes an entity called the Dynamic Requirements Collection management Authority (DRCMA), has the potential to reduce the time normally required for battlefield commanders to get collection requests into the hands of collector operators. However, two questions remain. *Even if the DRCMA works perfectly, will the entire shooter-to-sensor-to-shooter process be timely enough? Does the use of the HAE UAV to meet battlefield commander's dynamic collection requirements make sense?* The following sections will provide the insight necessary to answer these questions.

### B. TIMELINESS

The tasking process described in Chapter VI has the potential to reduce the time required for a battlefield commander to task a theater collection asset. Assuming the tasking process works flawlessly, there are still issues that must be resolved concerning the fusing and dissemination of the information that is collected. Traditionally, the exploitation and dissemination phase of the intelligence cycle account for much of the time it takes to get *usable* intelligence to the user. Taking this factor into consideration, the question arises if the total intelligence cycle is timely enough to meet dynamic requirements even if the

DRCMA process works perfectly. If the answer is likely not, then it may be wise to focus more attention on the exploitation and dissemination phases of the cycle.

The present is marked by more and more defense budget cuts. In many cases, the cost of a program is being forced to the forefront as the most important factor in the acquisition process. In fact, the only firm requirement of the HAE UAV program is to not exceed a unit flyaway price of \$10 million [Ref. 12]. Even if the HAE UAV was relatively inexpensive compared to current manned collectors, the technology required to increase the timeliness of the exploitation and dissemination phases may cost a great deal. Consequently, it may be more appropriate to consider another approach to meeting battlefield commander's real-time intelligence needs. Perhaps a cheaper and smaller UAV that provides ground commanders with an organic collection capability would make more sense with regard to timeliness.

### C. DEEP BATTLE CONSIDERATIONS

During Desert Storm, Army ground commanders complained about the air support they received. Even though the theater CINC was an Army officer and the Army deputy CINC was responsible for compiling the target list, ground commanders were still not satisfied. The CINC did not always see things the same way the Army ground commanders did at corps levels and below. [Ref. 32: p. 206-209]

Traditionally, ground force commanders are preoccupied with the battle directly in front of them and are less concerned with deeper and more strategic threats. This limited view of the battlefield is attributed by some as the cause for losses experienced at the fall of France in 1940 and the Kasserine in 1943. AirLand Battle doctrine was created by the Army to correct this dangerously "near-sighted" fixation. However, the problem clearly resurfaced during Desert Storm as target requests coming up from the lowest levels of the ground forces reflected a short-sighted perspective. [Ref. 32]

Fortunately, General Schwarzkopf had the "big picture" in mind, but this picture did not always support the ground force's targeting objectives. He realized that targeting objectives should be prioritized based on theater objectives and not on individual tactical needs. [Ref. 32] With this in mind, the Desert Storm experience may affect the way the CINC or JFC chooses to allocate scarce collection resources during a future conflict. If he has HAE UAVs available, he may choose to use them to support theater objectives at the expense of tactical needs, such as a ground commander's dynamic collection requirements.

#### **D. RANGE CONSIDERATIONS**

The near-sighted perspective demonstrated by ground forces during Desert Storm must be considered in light of the HAE UAV's long range and long loiter time capabilities. With a loiter time of 24 hours over a target 3000 NM from its operating base, the HAE UAV must have a superb capability to see deep within enemy territory for long periods of time. Figure 7-1 illustrates the capabilities of the HAE UAV compared to other UAVs.

Real-time collection requirements that ground forces encounter are more likely to be short range, as seen during Desert Storm. It is possible that ground special forces elements may require deep intelligence collection support, but their requirements will be few compared to those of the conventional ground force. During conflict, the JFC may not want to utilize the valuable capabilities offered by the HAE UAV to meet short range collection missions characteristic of dynamic collection requirements of ground forces. Based on Figure 7-1, the JFC may choose to use the HAE UAV for deeper reconnaissance and surveillance missions and use other available collectors to satisfy short range requirements. Figure 7-1 also helps to illustrate the dramatic difference in range capabilities between the various UAVs. If the JFC is faced with apportioning air assets against battlefield commander's real-time collection requirements, then it may make more sense to choose to use a

shorter range collector such as the Predator and preserve the HAE UAV for more demanding deeper reconnaissance missions.

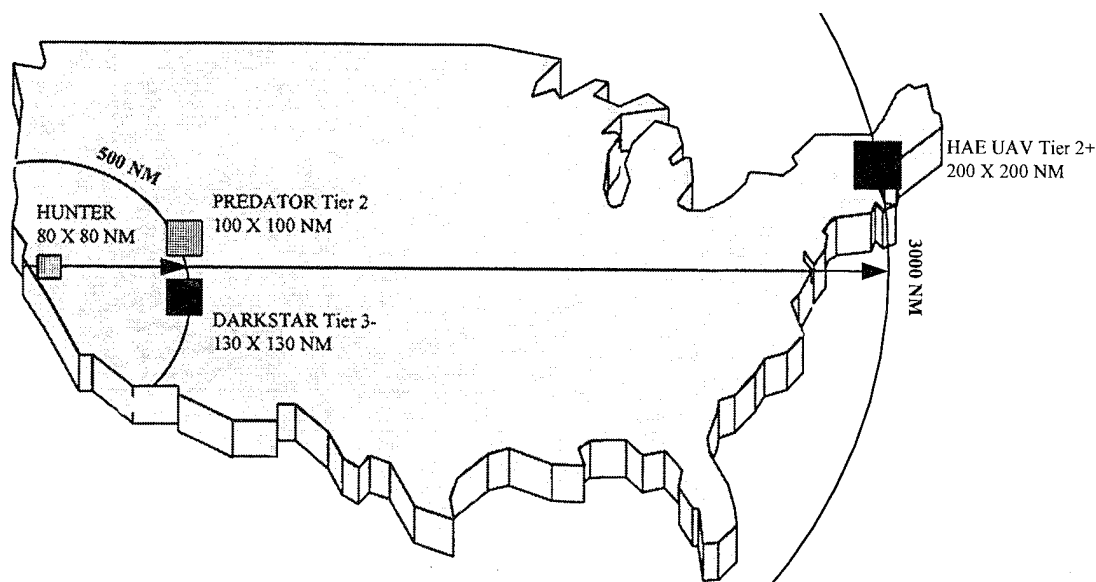


Figure 7-1. Operating ranges of various UAVs. From Ref. [14].

## E. CONCLUSIONS

The problems facing the warfighter today and tomorrow are significant. Desert Storm demonstrated just how quickly the battle can progress and how robust the intelligence system must be to meet such a demanding tempo on the battlefield. Changes, revisions and advancements in the current intelligence process are essential if US forces are to have the intelligence they need, when they need it on the modern battlefield. The HAE UAV offers some needed capabilities, and if used well, it has the potential to impact the quality of intelligence products. However, the processes and procedures through which the HAE UAV may operate must be transformed to support a higher operating tempo and dynamic requirements inherent to combat.

Current collection management procedures are not responsive enough to meet the dynamic collection requirements inevitable on the battlefield. JFC guidance, J-2 staff expertise, and skip-echelon procedures combined with the Dynamic Retasking Collection Management Authority process have the potential to reduce the time required for a battlefield commander to task the collector to meet his specific requirements. JCMT may provide the essential communication between the sensor and the shooter, and will also help the shooter to make better decisions concerning collector selection.

To summarize, the DRCMA process requires six distinct things to happen before it can work optimally. 1) The JFC must have confidence in the DRCMA process and provide the necessary guidance to ensure that the DRCMA process supports his priorities. 2) The command, control, and communication hierarchy must be in place to allow for effective communication between all the entities involved from lower level echelons (such as the division) to the DRCMA control and collector cells, and collector operators. 3) JCMT must provide robust communications between JCMT users, administrative tools, automatic request routing to the appropriate collector cells, collector models and capability/availability information. 4) An intimate working relationship must be established and maintained between the DRCMA and JAOC to maximize the overall effectiveness of air operations and to ensure deconfliction. 5) Battlefield commanders must be trained and equipped to choose the most appropriate collector for their particular dynamic requirements. 6) Smooth transitions must occur within the DRCMA chain-of-command for the shifting delegation of tasking authority based on the theater operating tempo and JFC guidance. The fulfillment of these six steps must occur in order for the DRCMA process to work effectively. These steps are not impossible, but will require a great deal of effort from all the entities involved in the process. Once these steps have been fulfilled, the DRCMA process will have the potential to streamline the tasking process, but changes in the exploitation and

dissemination phases are still necessary to reduce the total time from shooter-to-sensor-to-shooter.

Another factor to consider is the long range and long loiter time capabilities of the HAE UAV. These capabilities may be more appropriately used to fulfill deeper reconnaissance and surveillance missions to support the JFC's theater objectives at the expense of close range dynamic collection needs experienced by field commanders. The HAE UAV combined with the DRCMA process may offer a quick solution to a complex problem, but a more serious look and perhaps a rethinking of the entire concept may be a more appropriate approach for the long haul.



## LIST OF REFERENCES

1. Shaker, Steven M. and Wise, Alan R., *War Without Men. Robots on the Future Battlefield*, Pergamon-Brassey's International Defense Publishers, Inc., 1988.
2. *DOD's Use of Remotely Piloted Vehicle Technology Offers Opportunities For Saving Lives and Dollars*, Report to Congress, MASAD 81-20. US General Accounting Office, Washington, DC, April 3, 1981.
3. Fulghum, David A. and Morrocco, John D., CIA to Deploy UAVs in Albania. *Aviation Week and Space Technology*, January 31, 1994.
4. Morrocco, John D., Airlift, Intelligence Continue to Pose Problems. *Aviation Week and Space Technology*, January 17, 1994.
5. Cohen, Eliot A. and Keaney, Thomas A., *Gulf Air Power Survey Summary Report*, Washington DC, 1993.
6. Barnaby, Frank, *The Automated Battlefield*, The Free Press, A Division of Macmillan, Inc., 1986.
7. Snodgrass, David E., *Attacking the Theater Mobile Ballistic Missile Threat*, Air University, Maxwell Air Force Base, Alabama, June 1993.
8. Soutter, Paul A., *On the Use of Unmanned Aerial Vehicles to Search for Tactical Ballistic Missile Transporter-Erector-Launchers*, Master's Thesis, Naval Postgraduate School, Monterey, California, March 1994.
9. Cruise Missiles Project and Unmanned Aerial Vehicles Joint Project Office, *Pioneer UAV System*, VHS video tape, 1993.
10. *Unmanned Aerial Vehicles Program Plan*, DARO, April 1994.
11. *Integrated Airborne Reconnaissance Strategy*, DARO, 31 May, 1994.
12. *HAE UAV Concept of Operations*, Draft, ARPA, 10 February 1995.
13. Shaw, David, New Capabilities New Interest. The UAV Situation. *Defense News Marketing Supplement*, September 1995.

14. Fulghum, David A., *International Market Eyes Endurance UAVs*. *Aviation Week and Space Technology*, July 10, 1995.
15. *HAE UAV TIER II+ Primary Communications System*, UNISYS, 1994.
16. Oliveri, Frank, *Air Force Sees UAV Role in Targeting, Damage Assessment*. *Defense News*, August 14-20, 1995.
17. Joint Pub 2.0, *Joint Doctrine for Intelligence Support to Operations*, 12 October, 1993.
18. Joint Pub 3-55 *Reconnaissance, Surveillance, and Target Acquisition Support*, 14 April 1993.
19. Marshall, James P., *Near-Real-Time Intelligence on the Tactical Battlefield*, Air University, Maxwell Air Force Base, Alabama, January 1994.
20. Army Field Manual 34-2, *Collection Management and Synchronization Planning*, Final Approved Draft, October 1993.
21. Army Field Manual 34-1 *Intelligence and Electronic Warfare Operations*, July 1987.
22. Glenn, Kevin, *J-2 Staff during Operation Desert Storm*, Telephone Interviews, 19 September and 25 October 1995.
23. Joint Pub 3-56.1 *Command and Control for Joint Air Operations*, 14 November 1994.
24. Joint Pub 3-55.1 *Joint Tactics, Techniques, and Procedures for Unmanned Aerial Vehicles*, 27 August 1993.
25. *Joint Collection Management Tools*, Fact Sheet, TRW, 1995.
26. Joint Collection Management Tools briefing provided by the JCMT Program Management Office, September, 1995.
27. Joint Collection Management Tools demonstration at the Joint Warfare Interoperability Demonstration (JWID) at Camp Pendleton, CA. September 1995.
28. Scales, Robert H., *Certain Victory: The US Army in the Gulf War*, Office of the Chief of Staff United States Army, 1993.

29. *Providing Customers Worldwide Image Services on Demand...the United States Imagery System*, USIS-2000 Brochure, Central Imagery Office, 1995.
30. Oliveri, Frank, Who Will Control Spy Planes? *Air Force Times*, August 28, 1995.
31. Smetek, Ronald T., Tactical Intelligence: Greendoor to Battlefield, *Journal of Electronic Defense*, January, 1984.
32. Hallion, Richard P., *Storm Over Iraq: Air Power and the Gulf War*, Smithsonian Institution Press, 1992.



## INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center..... 2  
8725 John J. Kingman Road, Suite 0944  
Fort Belvoir, VA 22060-6218
  
2. Dudley Knox Library..... 2  
Naval Postgraduate School  
411 Dyer Road  
Monterey, CA 93943-5101
  
3. Director for Command, Control and..... 1  
Communications Systems, Joint Staff  
Washington, DC 20318-6000
  
4. Joint C4I Academic Group, Code CC..... 1  
Naval Postgraduate School  
589 Dyer Road. Room 202  
Monterey, CA 93943-5143
  
5. AFIT/NR..... 1  
Wright-Patterson AFB, OH 45433-6583
  
6. Rome Laboratory..... 1  
Attn: RL/CC  
26 Electronic Parkway  
Rome, NY 13441-4514
  
7. Rome Laboratory..... 1  
C3AA  
Attn: Captain Todd Waller  
525 Brooks Road  
Rome, NY 13441-4514
  
8. HAE-UAV Program Management Office..... 2  
DARPA  
Attn: Col Doug Carlson and LtCol Keith Matthews  
4001 N Fairfax, Drive, Suite 850  
Arlington, VA 22203-1714

9. DARPA..... 1  
Attn: Dr. Judith Daily  
3701 N. Fairfax  
Arlington, VA 22203-1714
10. PM JCMT..... 1  
Attn: Mark Jensen  
1616 Anderson Road  
McLean, VA 22102-1616
11. Professor Dan C. Boger, Code CC/Bo..... 1  
Department of Joint C4I Systems  
Naval Postgraduate School  
Monterey, CA 93943-5110
12. Professor Michael G. Sovereign, Code CC/Sm..... 3  
Department of Joint C4I Systems  
Naval Postgraduate School  
Monterey, CA 93943-5110